BOROUGH OF CONSHOHOCKEN PUBLIC SAFETY FACILTY

BOROUGH OF CONSHOHOCKEN

ALLOY5
ARCHITECTURE

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Bethlehem, PA 18018

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SECTION 00.1113 - ADVERTISEMENT FOR BIDS

The Borough of Conshohocken will receive sealed bids for the construction of the Borough of Conshohocken Public Safety Facility, located at 1111 Fayette Street, Conshohocken, Pennsylvania 19428.
Sealed bids for all Prime Contracts shall be submitted electronically through PennBid no later than **2:00 P.M., prevailing time, on Wednesday, December 9, 2026.** Electronic bids will be publicly opened immediately following the bid deadline at the Borough Hall, 400 Fayette Street, First Floor, Conshohocken, PA 19428. Bid results will be available through the PennBid website following the opening. Contract awards will be made by the Owner at a later date.

All Contract Documents will be available electronically in PDF format through PennBid at www.pennbid.net beginning at **12:00 P.M., Tuesday, November 3, 2026**, at no cost. A nominal fee of 0.33% of the bid amount (from $100 up to $5,000, plus tax) is assessed only to bidders awarded contracts.
Prospective bidders shall register with PennBid and provide the required company contact information (company name, contact person, complete address, phone numbers, and email address) and identify the Prime Contract(s) for which they intend to bid.

Construction will be bid for the following Prime Contracts:

Contract No. 1: General Construction
Contract No. 2: HVAC Construction
Contract No. 3: Electrical Construction
Contract No. 4: Plumbing Construction
Contract No. 5: Traffic Signal Modernization

There will be a **MANDATORY** pre-bid meeting for **ALL** contracts held at 400 Fayette Street, Conshohocken, Pennsylvania 19428 at **2:00 PM prevailing time on Monday, November 9, 2026**. Attendance of all Prime Contract Bidders is mandatory.

The Project site, 1111 Fayette Street, Conshohocken, Pennsylvania, 19428 will be available for Bidders, Subcontractors, and Vendor walk-through on Monday, November 9, 2026, between 10:00 AM and 2:00 PM prevailing time.

The Project Architect is Alloy5 Architecture, LLC, 530 West Broad Street, Bethlehem, PA, 18018, Phone: 610-419-4055.

This Project is subject to the Pennsylvania Prevailing Wage Act, Act of August 15, 1961, P.L. 987, No. 442, as amended. Prevailing wage rates established by the Secretary of Labor and Industry shall apply.

All bids shall conform to the requirements of the Contract Documents.

The apparent low bidder and the next two lowest bidders shall submit original executed bidding documents to the Architect within two (2) business days following the bid opening.
Each bid shall be accompanied by bid security equal to ten percent (10%) of the Base Bid.
The successful bidder(s) shall furnish Performance Bonds and Labor and Material Payment Bonds in the amount of one hundred percent (100%) of the contract value and as required by the Contract Documents.

The Borough of Conshohocken reserves the right to reject any or all bids, to reject any portion of any bid, and to waive any informalities or technicalities when deemed to be in the best interest of the Borough.

By Order of the BOROUGH COUNCIL
OF THE BOROUGH OF CONSHOHOCKEN

Stephanie Cecco, Borough Manager

TO APPEAR: November 3, 2026
November 6, 2026
November 9, 2026

QUALIFCATIONS QUESTIONNAIRE

Submitted To: _____
OWNER NAME

For consideration with regard to: _____
PROJECT NAME

Date: _____, _____

1. Companies that wish to bid on this Project must submit this Qualification Statement with their bids.

2. Only Companies which are determined to be responsible contractors under applicable law will be designated as qualified bidders.

3. The Instructions to Bidders govern the Owner's consideration of this completed Qualification Statement and any other requirements that will be considered in making an award.

4. All prospective bidders must complete this form by answering all questions, and supplying all requested documents, using the spaces indicated (with additional pages if necessary) and attaching documents as required and submit the completed form with their bid by the deadline established in the Invitation to Bid.

I. Capability

1. Form of organization (sole proprietorship, partnership, corporation, etc.)

_____

_____

_____

_____

2. Years the organization has been in business as a contractor under its present name.

_____

_____

_____

_____

3. List of all affiliated or subsidiary organizations and companies.

_____

_____

_____

4. List of all organizations and individuals who have a financial interest in or a specified percentage in the company.

5. Any other organization or individual who controls bidding or operation of the Company.

6. Identification of all offices.
   a. Main Office: _____
   b. Additional Locations: _____

7. The numbers, categories and locations of all employees and officers.

8. The officers, administrators, managers and superintendents who will be assigned to the project - identification of qualifications, with specific attention to years in present position, years of construction experience, and magnitude and type of work.

9. Previous Work for Owner: Identify any work the Bidder has previously performed for the Owner. For each project, identify the project name and location, nature of the contract, scope of work, contract amount, and completion status.

10. Relevant Public Project Experience: Identify up to ten of the Bidder's most recent public projects in Pennsylvania that are relevant to the type and scope of construction contemplated by this Request for Qualifications. Include projects on which the Bidder served as prime contractor, subcontractor, or other principal contracting party, as applicable. For each project, identify the following:
    a. Name and address of Owner;
    b. Project name and location;
    c. Nature of contract and Bidder's role;
    d. Nature and scope of work;
    e. Original contract amount;
    f. Change orders and final contract amount, if applicable; and
    g. Whether the project was completed on time.

11. Other Relevant Experience: Identify additional projects, whether public or private, performed by the Bidder that demonstrate relevant experience with the type of construction contemplated by this Request for Qualifications. For each project, identify the Owner, project name and location, Bidder's role, nature and scope of work, and contract amount.

12. Projects constructed with Critical Path Method (CPM) or some other form of computerized project scheduling and capabilities that otherwise can be provided. For each, identify the name and address of owner, location of project, nature of contract (prime, sub, etc.), contract amount, kind of work, and nature of project.

13. Projects awarded but which the Company failed to complete. Identify dates, name and address of owner, name and location of project and kind of work, and the reasons the project was not completed.

14. Equipment owned that will be utilized on the project by type, size or capacity, years of service, and condition.

15. Leased equipment that will be utilized on the project by type, size or capacity, years of service, and condition.

16. Portion of the contract to the nearest ten percent (10%) that the bidder expects to perform using its own labor and equipment.

II. Financial Integrity

1. Attach the most recent audited and CPA certified financial statement, with certification, date of preparation, name and address of preparer (financial information can be treated as confidential in accordance to PennBid procedures).

2. Net working capital (current assets over current liabilities) and date of determination.

3. Identification of credit lines, with information on the total lines, amounts drawn down and amounts remaining.

_____

_____

4. Identification of the contractor's surety for the required performance bond, total bonding capacity and available bonding capacity. Also list bonding company A.M. Best Rating and Financial Rating for compliance with project requirement. The qualifications of the bonding company should be a surety company designated as acceptable surety in Circular 570, as amended by the Audit Staff of the Bureau of Government Financial Operations U.S. Treasury Department.

_____

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_____

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III. Conduct

1. All felony convictions, all bidding related offenses, and all misdemeanor convictions involving moral turpitude of the Company, its affiliates, its owners holding more than a specified percentage interest (25%), its officers, and its administrators, managers, and superintendents that will be assigned to the project.

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2. Debarments, suspensions, and denials of pre-qualification of the Company for any federal, state, local or governmental contracting.

_____

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3. Construction-related disputes of any kind including lawsuits, arbitrations, mechanics liens, and other claims that the Company has been involved in. Provide a summary of each item.

_____

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4. Proceedings of an administrative enforcement nature of whatever kind, including environmental, wage and hour, prevailing wage, employment discrimination, or other kind of proceeding. Provide a summary of each item.

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5. List any prevailing wage disputes, investigations or complaints filed against the Company or any officers.

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6. Unpaid obligations to local, state, or federal taxing authorities, including but not limited to income, withholding and unemployment taxes.

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7. Cancellation, termination or rescission of contracts of insurance or suretyship.

_____

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8. Provide all other information requested in accordance with Instructions to Bidders or any other information requested by Owner as part of its investigation.

IV. Safety and Training

1. Provide a copy of your Workmen's Compensation Experience Modification Factor for the past three (3) years.

2. Identify any safety violations, accidents or injuries on any projects over the last five (5) years.

_____

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3. Provide a summary and proof of any training or other programs that are available, endorsed or paid by your company and made available to employees.

_____

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_____

4. Provide a summary of your safety training and compliance programs.

_____

_____

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_____

_____

V. Ethics Act

1. The owners of the Company and their immediate family members, including parents, spouse, children, brothers, and sisters, are not related by blood or marriage to, and have no business, financial, or other relationship with, any elected or appointed official, officer, employee, or representative of the Owner that would create or reasonably appear to create a conflict of interest in connection with the Company's participation in this project, except as follows:

   If familial or business relationship(s) exist, please identify.

   _____

   _____

   _____

   _____

   _____

When the Bidder is an individual proprietor:

WITNESS:

_____ _____(SEAL)

Signature of Witness Signature of Proprietor

_____

Print Name of Proprietor

When the Bidder is a partnership:

_____

Print Name of Partnership

_____

Address

_____

City, State, Zip Code

_____

Phone Number with Area Code

WITNESS:

_____ _____(SEAL)

Signature of Witness General Partner

When the Bidder is a corporation:

_____

Print Name of Corporation

_____

Address

_____

City, State, Zip Code

_____

Phone Number with Area Code

ATTEST:

_____

Secretary/Assistant Secretary/
Treasurer/Assistant Treasurer or
other authorized representative

BY:_____(SEAL)

President/Vice President or
other authorized representative

_____

Print Name of Corporate Representative

(CORPORATE SEAL)

END OF SECTION

AGREEMENT OF SURETY

KNOW ALL MEN BY THESE PRESENTS, that we, _____ as Surety, a corporation existing under the laws of the State of _____, and authorized to transact business in the Commonwealth of Pennsylvania hereby agree intending to be legally bound hereby, to execute and deliver to Borough of Conshohocken, within the time limit specified in the Contract Documents, the Performance Bond and Labor and Material Payment Bond in the forms included in the Contract Documents each in an amount of 100% of the contract amount, in favor of Borough of Conshohocken, as required for the faithful performance and proper fulfillment of the contract for the Borough of Conshohocken Public Safety Facility for the Borough of Conshohocken as set forth in the Contract Documents on behalf of

_____ (hereinafter called the Bidder) provided that the above contract be awarded to the bidder within sixty (60) days after the date of opening of the bids or otherwise as set forth in the Instructions to Bidders.

DATED: _____, _____ _____

(CORPORATE SURETY)

ATTEST: _____ BY: _____

Secretary President

(CORPORATE SEAL)

SECTION 001155 - LETTER OF INSURER

DATE: _____

TO: **Stephanie Cecco, Borough Manager**
Borough of Conshohocken
400 Fayette Street
Conshohocken, PA 19428

Dear **Stephanie Cecco**:

The undersigned insurance agent, licensed to do business in the Commonwealth of Pennsylvania and authorized to issue this letter on behalf of the following insurance company or companies:

_____

_____

hereby represents that if

_____
(Insert name of Bidder)

is awarded the contract for the construction of the project, as is described in the Contract for Construction, then the above-named insurance company or companies will issue insurance, naming Borough of Conshohocken and its Architect as additional insured, for the coverages and in the amounts required by the Contract Documents, as set forth in Article 11 of the General Conditions.

_____
(Name of Agent)

By: _____
(Authorized Representative)

SECTION 002113 - INSTRUCTIONS TO BIDDERS

1. DEFINITIONS

1.1 Bidding Documents include the Bidding Requirements and the Proposed Contract Documents. The Bidding Requirements consist of the advertisement or invitation to bid, Instructions to Bidders, supplementary instructions to bidders, the bid form, and any other bidding forms. The Proposed Contract Documents consist of the unexecuted form of Agreement between the Owner and Contractor and that Agreement's Exhibits, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, all Addenda, and all other documents enumerated in these Instructions.

1.2 Definitions set forth in the General Conditions of the Contract for Construction, or in other Proposed Contract Documents apply to the Bidding Documents.

1.3 Addenda are written or graphic instruments issued by the Architect, which, by additions, deletions, clarifications, or corrections, modify or interpret the Bidding Documents.

1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

1.5 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents, to which Work may be added or deleted by sums stated in Alternate Bids.

1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from, or that does not change, the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

1.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, as described in the Bidding Documents.

1.8 A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

2. COPIES OF BIDDING DOCUMENTS

2.1. Complete sets of PDF documents may be obtained at no cost via PennBid (www.pennbid.net).

2.2. Complete sets of Bidding Documents must be used in preparing Bids; neither Owner nor Architect assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents. Bid Documents consist of Contract Documents (and all reference standards), specifications, addenda and drawings. Bidder is responsible to make sure that the set of Bidding Documents is complete and that any printed contract document is legible and represents properly all the information as represented in the PDF file.

2.3. Owner and Architect, in making copies of the Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids on the Work and do not confer a license or grant for any other use.

3. QUALIFICATIONS OF BIDDERS

3.1 By submitting a Bid, the Bidder represents that:

3.1.1 the Bidder has read and understands the Bidding Documents;

3.1.2 the Bidder understands how the Bidding Documents relate to other portions of the Project, if any, being bid concurrently or presently under construction;

3.1.3 the Bid complies with the Bidding Documents;

3.1.4 the Bidder has visited the site, become familiar with local conditions under which the Work is to be performed and has correlated the Bidder's observations with the requirements of the Proposed Contract Documents;

3.1.5 the Bid is based upon the materials, equipment, and systems required by the Bidding Documents without exception;

3.1.6 the Bidder has read and understands the provisions for liquidated damages, if any, set forth in the form of Agreement between the Owner and Contractor; and,

3.1.7 the Bid has been arrived at independently, without consultation, communication, or agreement as to any matter relating to this Bid, with any other Bidder or with any competitor.

3.2 **The following information must be completed and submitted with the appropriate bid form.**

3.2.1 Section 001153 – Completed Request for Qualifications questionnaire. Bidder to use additional pages to complete any of the sections if more space is needed. Bidder's failure to fully and accurately disclose all information requested in the Request for Qualifications questionnaire shall constitute grounds for Bidder's disqualification from being considered the lowest responsive, responsible Bidder.

3.2.2 Section 001154 – Executed Agreement of Surety and appropriate Power of Attorney.

3.2.3 Section 001155 – Executed Letter of Insurer.

3.2.4 Section 004300 – Executed Bid Security as referenced in Article 6 of this Document.

3.2.5 Section 004519 – Executed and notarized Non-Collusion Affidavit.

3.3 To demonstrate qualifications to perform the Work, each Bidder must be prepared to submit within FIVE (5) days of Owner's request, written evidence such as financial data, insurance certificates, previous experience of the Bidder and its assigned personnel, present commitments and any other information that may be requested by the Owner. Each Bid must contain evidence of Bidder's qualification to do business in the state where the Project is located, or covenant to obtain such qualification prior to award of the Contract. Owner reserves the right to reject Bidder if he cannot satisfy all of the Qualification Requirements, including those listed in the Technical Specifications.

3.4 In determining the lowest responsible Bidder, the Owner will consider the Bidder's integrity, efficiency, experience of the Bidder and its assigned personnel, promptness, current work load,

financial capability, performance on recent projects, references from Owners, Architects and Engineers, potential list of sub-contractors, schedule of values, and ability to successfully and timely complete the Project. The Owner will scrutinize the apparent low Bidder's information for full disclosure before intent to award is issued. The apparent low Bidder must demonstrate competency and provide any or all of the above information requested within FIVE (5) days of request. Owner reserves the right to reject Bid if all the information is not received on time and/or does not satisfy the Owner's evaluation process.

3.5 In addition to all the requirements specified in Articles 3.1, 3.2 and 3.3 regarding qualifications of Bidders, the Owner will evaluate bidders using the following additional criteria:

3.5.1 The Bidder and its assigned personnel, must have successfully performed a minimum of 3 previous public projects within the last FIVE (5) years of similar type or a contract value of at least seventy percent (70%) of the amount of the bidder's base bid. Provide references including telephone number and contact person.

3.5.2 The Bidder shall perform not less than ten percent (10%) of the actual construction Work with staff employed directly by the company. Project management shall NOT be included in this percentage.

3.5.3 The Bidder, or its assigned personnel, must have successfully performed at least 3 public projects within the last FIVE (5) years where they have managed multiple trades and coordinated and scheduled all the activities for projects as per 3.4.1. Provide references including telephone number and contact person.

3.5.4 An agreement of Surety certifying that the Surety Company is committed to provide the bidder with a Performance Bond and Payment Bond each in the amount of one hundred percent (100%) of the contract amount. The Surety Company must have an AM Best rating of A- or better and a financial rating of Class X or higher.

3.5.5 The Bidder's performance on previous projects including claims, litigation, coordination of work, staffing and timely completion. If it is determined that the bidder does not have a good track record on previous projects, the Owner reserves the right to reject the bid.

3.5.6 The Bidder shall also refer to Articles 11 and 16.

4. EXAMINATION OF CONTRACT DOCUMENTS AND SITE

4.1. It is the responsibility of each Bidder, before submitting a Bid, to:

4.1.1. Examine the Contract Documents thoroughly.

4.1.2. Visit the site to become familiar with local conditions that may affect the cost, progress, performance, or furnishing the Work.

4.1.3. Consider federal, state, and local laws and regulations that may affect cost, progress, performance, or furnishing of the Work.

4.1.4. Study and carefully correlate Bidder's observations with the Contract Documents.

4.1.5. Notify Architect of any conflicts, errors, or discrepancies discovered in the Contract Documents.

4.2. REVIEW OF DRAWINGS AND SPECIFICATIONS

4.2.1. Bidders shall thoroughly examine and be familiar with the Specifications and Drawings. The failure or omission of any Bidder to receive or examine any form, instrument, document, or visit the site and acquaint himself with conditions there existing, shall in no way relieve any Bidder from obligation with respect to his Bid. By submitting a Bid, the Bidder agrees and warrants that he has examined the site and the Specifications and Drawings and, where Specifications and/or Drawings require in any part of the Work a given result to be produced, that the Specifications and Drawings are adequate and the required result can be produced under the Specifications and Drawings. No claim for any extra will be allowed because of alleged impossibilities in the production of the results specified or because of inadequate or improper plans and specifications and whenever a result is required, the successful Bidder shall furnish any and all extras and make any changes needed to produce the required result for the sum stated in the form of proposal.

4.2.2. Should any Bidder find discrepancies, duplications or omissions in the documents or have doubt as to the meaning expressed by the Contract Documents, he shall make inquiry at once in writing to the Architect. Where changes, corrections or clarifications to Contract Documents are deemed necessary by the Architect, he will issue written Addenda accordingly. Addenda shall be a part of the Contract Documents. No oral, telephone or letter instructions will be considered as having effect upon the Contract Documents; Addenda only shall constitute change to them. Bidders and Sub-bidders are urged to make early examination of Contract Documents and make inquiries about them if necessary, even though prices may not be determined until late in the bidding period.

4.3. The site will be available for visits at the pre-bid conference and at the other specific designated dates and times determined at the pre-bid.

4.4. Information and data reflected in the Contract Documents with respect to Underground Facilities at or contiguous to the site is based upon information and data furnished to Owner and Architect by owners of such Underground Facilities or others, and Owner and Architect do not assume responsibility for the accuracy or completeness thereof. Contractor shall verify the location of all underground utilities prior to any excavation.

4.5. General Contractor is responsible, on behalf of the Owner, for providing the physical markings of all existing utilities including those on site as indicated on the drawings or that may be identified in the field. The locations shown on the drawings are approximate. The Bidder must include in his proposal the cost for hand-dug test holes, or other means, to ascertain the precise position of such underground facilities on the site owned by the Owner. This verification should be performed for any utilities to be relocated, removed, modified or that may otherwise interfere with planned work. The utilities in the public right of way will be identified and marked by the appropriate facility owner as per the requirements of the PA One Call Act as amended. Physical layout is to be performed in full compliance with the PA One Call PA Act 287 of 1974 as amended by Act 18 of 1996.

4.6. The Owner and Architect will not be responsible for the adequacy of data furnished to prospective Bidders on subsurface conditions, Underground Facilities and other physical conditions. This information is provided based on information available. Bidder assumes responsibility for verifications, adjustments and modifications that may be required since this is generally recognized as inherent to the work of the Contract Documents.

4.7. Before submitting a Bid, each Bidder will, at Bidder's expense, make or obtain any additional examinations, investigations, explorations, tests and studies and obtain any additional information and data which pertain to the physical conditions (surface, subsurface and Underground Facilities) at or contiguous to the site or otherwise which may affect cost, progress, performance or furnishing the Work and which Bidder deems necessary to determine its Bid for performing and furnishing the Work in accordance with the time, price and other terms and conditions of the Contract Documents.

4.8. On request in advance, Owner will provide each Bidder access to the site to conduct such explorations and tests, as each Bidder deems necessary for submission of a Bid. Bidder shall fill all holes, clean up and restore the site to its former condition upon completion of such explorations.

4.9. The lands upon which the Work is to be performed, rights-of-way and easements for access thereto and other lands designated for use by the Bidder in performing the Work are identified in the Contract Documents. All additional lands and access thereto required for temporary construction facilities or storage of materials and equipment are to be provided by Bidder. Easements for permanent structures or permanent changes in existing structures are to be obtained and paid for by Owner unless otherwise provided in the Contract Documents.

4.10. The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of the bid documents and, that without exception, the Bid is premised upon performing and furnishing the Work required by the Contract Documents and such means, methods, techniques, sequences or procedures of construction as may be indicated in or required by the Contract Documents, and that the Contract Documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

5. INTERPRETATIONS AND ADDENDA

5.1 All questions about the meaning or intent of the Contract Documents are to be directed as listed below. Interpretations or clarifications considered necessary by the Architect in response to such questions will be issued through PennBid. PennBid will provide notifications of the presence of new addenda to any registered potential bidders. Questions received after RFI cut-off date (to be specified in addendum) may not be answered.

5.2 Only questions answered by formal written Addenda will be binding. Oral or other interpretations or clarifications will be without legal effect.

Addenda may also be issued to modify the Bidding Documents as deemed advisable by Owner or Architect.

5.3 All questions must be submitted in writing through PennBid. Phone calls are not permitted.

6. BID SECURITY

6.1 A proposal shall be rejected unless accompanied by a Bid Security in the amount of ten percent (10%) of the total of the Base Bid and all possible add alternates. Bid Security shall be in the form of a certified check or bank cashier's check payable to Owner or a Bid Bond in the form set forth herein, naming as obligee, the Owner.

6.2 The Owner may declare the Bid Security forfeited to the Owner if, following such issuance of a Notice of Intent to Award to the apparent lowest responsible Bidder, such Bidder fails to deliver the items required for complete evaluation and for contract execution required by the Bid Documents and within the time required by the Bid Documents.

6.3 If Bid Security is submitted in the form of a Bid Bond, the Bid Bond shall be submitted on the form referenced in the Bidding Documents, and the Attorney-in-Fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of its Power of Attorney, authorizing said Attorney-in-Fact to act on behalf of the surety. The Power of Attorney must be dated the same date as the Bid Bond and both the Bid Bond and Power of Attorney shall have affixed the raised corporate seal of the surety. The Bid Bond form must be executed by a surety licensed and authorized to conduct business as a surety within the Commonwealth of Pennsylvania, have an AM Best rating of 'A-' or higher and a financial rating of Class X or higher and shall be named in the current list of companies holding Certificates of Authority as acceptable sureties on federal bonds and/or as acceptable reinsuring companies as published in Circular 570 (as amended) by the Audit Staff, Bureau of Government Financial Operations, U.S. Treasury Department, and the amount of the bond shall not exceed the underwriting risk of such surety set forth in said circular of revisions thereof. Any bond must be acceptable to Owner.

6.4 The Bid Security of Bidders will be returned (unless forfeited as stated above) at the Bidder's request, upon (1) the execution of the Agreement Between Owner and Contractor by Owner, or (2) the rejection of all bids by Owner, or (3) the expiration of the firm bid period set forth in Section 12 of these Instructions to Bidder. The Owner shall not be liable for any interest on bid security which is held in accordance with these Bidding Instructions.

7. NON-COLLUSION AFFIDAVIT

More than one proposal for the contract from an individual, partnership, corporation, or an association under the same or different name will be grounds for the rejection of all proposals in which such Bidder is interested. Any or all proposals will be rejected if there is reason for believing that collusion exists among any of the Bidders. Participants in such collusion will not be considered in future proposals. A Non-Collusion Affidavit shall be executed and submitted with the Bidder's proposal using the form set forth herein.

8. CONTRACT TIME

The Bidder acknowledges that a condition of the Contract is that time is of the essence of the Contract and the number of calendar days within which, or the dates by which, the Work is to be substantially

completed and completed and ready for final payment (the Contract Time) are set forth in the Contract Documents and are accepted by the Bidder without exception or conditions.

9. LIQUIDATED DAMAGES

Provisions for liquidated damages are set forth in the Contract Documents.

10. SUBSTITUTE OR "OR-EQUAL" ITEMS

The various materials and products specified in the specifications by name or description are given to establish a minimum acceptable standard of quality and of cost for bid purposes. When proprietary names are used, and there does not follow a "listing" of acceptable approved manufacturers and/or products, then the proprietary named item must be included in the bid proposal without substitution. When proprietary names are used, and there follows a "listing" of acceptable "approved" manufacturers and/or products, then the bidder may base the bid on either the proprietary product or any from the "listing". Bidders may request approval prior to bid opening of non-listed items in accordance with the specifications. When proprietary names are used, and there are alternates on the bid form, then the bidder shall base his bid on the proprietary product or any from the "listing" of approved manufacturers and/or products. The bidder must furnish the specified or listed item regardless of whether or not they were included in his bid. The bidder shall be required to coordinate and pay for any conditions which are required to accommodate the listed or alternate item, including the reimbursement of other affected prime contractors.

No substitutions (alternatives) will be considered prior to receipt of Bids unless written request for approval has been received by the Architect only from prime Contract Bidders at least TEN (10) days prior to the date for receipt of Bids. Such requests shall be in accordance with substitution request procedure, and any other requirements at the Architect or Owner's discretion.

In order to prequalify, all alternative Manufacturers' information should be submitted by a prime contract bidder and should include:

- Technical, warranty, and Manufacturer's data specified. A line-by-line comparison of all specified items in the Specification must be made. Submission must be made TEN (10) days prior to Bid opening.
- Architect will review submission and any acceptable substitutions will be listed in an addendum. All manufacturers not specifically approved by addendum shall not be considered.
- Only manufacturers that are qualified prior to the Bid Opening will be considered acceptable Manufacturers.

10.1 The approval of a substitution shall be at the sole determination of the Architect and upon approval of the Owner, if a proposed substitution (alternative) is approved prior to receipt of Bids, such approval will be set forth in an addendum. Bidders shall not rely upon approvals in any other manner. If a proposed substitution is not specifically approved by addendum they are rejected.

10.2 No substitutions (alternatives) will otherwise be considered after the Contract award.

10.3 No substitutions (alternatives) will be considered for pre-bid approval later than TEN (10) days before bids are due.

11. SUBCONTRACTORS, SUPPPLIERS, AND OTHERS

11.1 All subcontractors proposed for the project shall have been in business for a minimum of FIVE (5) years and must have a successful record of completing, at a minimum, FIVE (5) projects of similar size and cost. Subcontractors must also have business insurance, workmen's compensation, adequate resources of man power, tools and equipment and must be defined as an independent contractor by the IRS.

11.2 At the Owner's request the identity of certain Subcontractors, Suppliers and other persons or organizations (including those who are to furnish the principal items of material and equipment) is to be submitted to Owner in advance by the apparent Successful Bidder, and any other Bidder so requested. Within FIVE (5) days after the Bid Opening, submit to Owner a list of all such Subcontractors, Suppliers and other such persons or organizations proposed for those portions of the Work for which such identification is required. An experience statement shall accompany such list with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, person or organization if requested by Owner. If Owner and Construction Manager, after due investigation, have reasonable objections to any proposed Subcontractor, Supplier, and other person or organization, then Owner may, before the Notice of Award is given, request the apparent Successful Bidder to submit an acceptable substitute without an increase in Bid Price.

11.3 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposed to use acceptable Subcontractors, Suppliers, and other persons and organizations. Declining to make requested substitutions will not constitute grounds for sacrificing the Bid Security of any Bidder.

12. BID FORM

12.1 THE BID FORM SHALL NOT BE ALTERED. ALTERED BID FORMS MAY BE CONSIDERED NON-RESPONSIVE AND MAY BE REJECTED.

12.2 The Bid Form is included with the Bidding Documents; NO additional copies will be provided. Bidders are to complete the bid forms electronically within PennBid.

12.3 All the blanks of the Bid Form must be completed electronically within PennBid.

12.4 Bids by corporations must be executed in the corporate name by the president or a vice-president (or other corporate officer accompanied by the evidence of authority to sign) and the corporate seal must be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation must be shown below the signature.

12.5 Bids by partnership must be executed in the partnership name and signed by a partner, whose title must appear under the signature, and the official address of the partnership must be shown below the signature.

12.6 All names must be provided in written words below the signature.

12.7 The Bid shall contain an acknowledgement of receipt of all Addenda (the numbers of which must be filled in on the Bid Form). Properly issued Addenda shall be binding upon all Bidders, regardless of whether a Bidder fails to acknowledge receipt.

12.8 The address and telephone number for communications regarding the Bid must be shown.

12.9 If there is a discrepancy between the written words and numerical figures written on the bid form, the written words shall prevail.

13. SUBMISSION OF BIDS

Bids shall be submitted electronically via PennBid, accompanied by the Bid Security and non-collusion affidavit. Bids submitted by any other means shall not be considered. One copy of all Documents required to be submitted at the time of Bid shall be submitted as part of the uploaded "Supporting Documents".

13.1 All applicable laws, ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the Project, shall apply to the Contract throughout.

14. MODIFICATIONS AND WITHDRAWAL OF BIDS

14.1 Bids shall be irrevocable for SIXTY (60) days after the actual day of opening thereof unless delayed by the required approval of another governmental agency, the sale of bonds or the award of a grant, in which case, Bids shall be irrevocable for ONE HUNDRED TWENTY (120) days after Bid opening. Extensions of the date for the award of contract may be made by the mutual written consent of Owner and the lowest responsible and responsive Bidder.

14.2 Neither the designation of the apparent lowest responsible Bidder, nor the issuance of a Notice of Intent to Award to the Bidder so designated shall operate to release any other Bidder from its Bid. Each such other Bidder, unless earlier released from its Bid by specific action of the Owner, shall remain bound by its Bid until the earlier of (1) the date of actual execution by Owner of the Agreement Between Owner and Contractor with the Bidder whom the Award of Contract has been made, or (2) the expiration of the firm Bid period stipulated above.

14.3 Negligence by the Bidder in preparing his proposal confers no right of withdrawal or modification of his proposal after such proposal has been opened. No claims on account of mistakes or omissions of any proposal will be considered. Notwithstanding the above, a Bidder may withdraw his proposal within TWO (2) business days after the Bid opening time in accordance with the Public Contracts – Withdrawal of Bids Law, Act of January 23, 1974, P.L. 9, No. 4, 73 P.S. §1601 et seq., as amended. A Bid which has been opened may be withdrawn only in accordance with the causes set forth in said Act and for no other reasons. Strict compliance with said Act is required to withdraw a Bid after opening.

15. OPENING OF BIDS

Bids will be opened and (unless obviously non-responsive) read aloud publicly. An abstract of the amounts of the Base Bids and major alternate(s) (if any) will be made available to Bidders after the opening of the Bids.

16. AWARD OF CONTRACT

16.1 The Owner's intent is to enter into Contracts with the lowest responsible and qualified Bidders.

Bid forms shall NOT BE ALTERED IN ANY MANNER. Owner reserves the right to reject any and all bids, to waive all informalities or technicalities and to negotiate contract terms with the Successful Bidder, and the right to disregard all nonconforming, non-responsive, unbalanced or conditional bids. Also, Owner reserves the right to reject the Bid of any Bidder if Owner believes that it would not be in the best interest of the Project to make an award to that Bidder, whether

because the Bid is not responsive or the Bidder is unqualified or of doubtful financial ability or fails to meet any other pertinent standard or criteria established by Owner. Discrepancies in the multiplication of units of Work and unit prices will be resolved in favor of the correct sum.

16.2 In evaluating Bids, Owner will consider the qualifications of such Bidders (see Article 3), whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices and other data, as may be requested in the Bid Form or prior to the Notice of Award.

16.3 Owner may consider the qualifications and experience of Subcontractors, Suppliers, and other persons or organizations proposed for any portions of the Work requested by Owner. Owner also may consider the operating costs, maintenance requirements, performance data and guarantees of major items of materials and equipment proposed for incorporation in the Work when such data is required to be submitted prior to the Notice of Award.

16.4 Owner may conduct such investigations as Owner deems necessary to assist in the evaluation of any Bid and to establish the responsibility, qualification and financial ability of Bidders, Subcontractors, Suppliers, and other persons or organizations to perform and furnish the Work in accordance with the Contract Documents to Owner's satisfaction within the prescribed time.

16.5 If the Contract is to be awarded, Owner will give the Successful Bidder a Notice of Intent to Award within SIXTY (60) days after the day of Bid Opening unless delayed by the required approval of another governmental agency.

16.6 The Owner reserves the right to waive non-material defects in any bid if it determines that it is in its best interest to do so. The Owner reserves the right to reject all bids.

17. CONTRACT SECURITY & INSURANCE

The General Conditions and the Supplementary Conditions set forth Owner's requirements as to Performance, Payment Bonds and Insurance requirements.

17.1 The apparent low bidder must provide Payment and Performance Bonds in the form included in the Contract Documents within TEN (10) days of the issuance of Notice of Intent to Award. Other bond forms will not be accepted. Failure of the apparent low bidder to provide original executed Payment and Performance Bonds in the required form within the required time will result in forfeiture of the Bid Security.

18. SIGNING OF AGREEMENT

When Owner issues Intent to Award to the Successful Bidder, the Bidder shall within TEN (10) days thereafter, deliver to the Owner, FOUR (4) original copies of the required Bonds and Insurance Certificates. Within TEN (10) days thereafter, the Architect will deliver FOUR (4) agreements to Bidder. The Bidder shall sign the agreements and return all original documents to the Architect .The Architect will forward the agreements to the Owner for signature. The Owner will return ONE (1) signed agreement to the Bidder and Architect.

19. RETAINAGE

Retainage will be in accordance with the Contract Documents.

20. PREVAILING WAGES

Pennsylvania Prevailing Wage Predetermination rates will apply to this Project. The Bidder shall keep an accurate record showing the name, craft and actual hourly rate of wage paid to each workman employed by him and such record shall be preserved for TWO (2) years from date of payment. The records shall be open at all reasonable hours to the inspection of the public body awarding the Contract and to the Secretary of the Department of Labor and Industry. The Architect assumes no responsibility to verify or document records of the Bidder or Contractor(s). Any failure of the Contractor or notification to the same in regards to wage rates or payment will require the Owner to withhold payments until the record is resolved.

21. COMPETENT WORKMEN

No person shall be employed to perform any work under the Contract if they are not legally eligible to be employed under applicable state and federal law or if they are not a trained, competent workman or mechanic, as applicable. For purposes of this Section, no workman or mechanic, as applicable, shall be regarded as competent unless he shall be duly skilled in the applicable branch of labor.

21.1 The Commonwealth of Pennsylvania enacted Act 127 of 2012, known as the Public Works Employment Verification Act ('the Act') which requires all public work contractors and subcontractors to utilize the Federal Government's E-Verify system to ensure that all employees performing work on public work projects are authorized to work in the United States.

The Department defines a "Public Work" to be construction, reconstruction, demolition, alteration and/or repair work other than maintenance work, done under contract and paid for in whole or in part out of the funds of a public body where the estimated cost of the total project is in excess of twenty-five thousand dollars ($25,000) but shall not include work performed under a rehabilitation or manpower training program.

The Department of General Services' Public Works Employment Verification Compliance Program is responsible for the administration, education and enforcement of the Public Works Employment Verification Act 127 of 2012. It provides contractors and subcontractors with educational outreach, conducts investigations when complaints are received and random audits to ensure compliance with the requirements of this Act.

Please direct your questions to the Public Works Employment Verification Compliance Office

Mail: Department of General Services Public Works

Employment Verification Compliance Office Room 105 Tent Bldg.

18th & Herr Streets

Harrisburg, PA 17125

Statement of Policy as published in the Pennsylvania Bulletin, December 29, 2012, and effective January 1, 2013. Public Works Employment Verification Form attached.

21.2 Before commencing the Work, Contractor shall supply the Owner with state and federal criminal history reports and child abuse clearances for all employees, agents and subcontractors who will be on the Owner's property. The original clearances must be presented to the Owner prior to each employee, agent or subcontractor coming on the Owner's property. All such clearances shall be dated no earlier than one year prior to the date of presentation to the Owner. The Owner shall retain a copy of all such clearances in its file. Notwithstanding any other provision of the Contract, violation of this provision shall constitute grounds for immediate termination of the contract by the Owner.

22. PENNSYLVANIA HUMAN RELATION ACT 222:

22.1 Human Relations Act: The provisions of the Pennsylvania Human Relations Act, Act 222 of October 27, 1955 (P.L. 744) (43 P.S. Section 951, et. Seq.) of the Commonwealth of Pennsylvania prohibit discrimination because of race, color, religious creed, ancestry, age, sex, national origin, handicap or disability, by employers, employment agencies, labor organizations, contractors and others. The Contractor shall agree to comply with the provisions of this Act as amended that is made part of this specification. Your attention is directed to the language of the Commonwealth's non-Discrimination Clause in 16 PA Code 49.101.

23. NON-DISCRIMINATION / SEXUAL HARASSMENT:

23.1 In the hiring of any employees for the manufacture of supplies, performance of work, or any other activity required under the Contract or any subcontract, the GRANTEE, subcontractor or any person acting on behalf of the GRANTEE or subcontractor shall not by reason of gender, race, creed, or color discriminate against any citizen of this Commonwealth who is qualified and available to perform the work to which the employment relates.

23.2 Neither the CONTRACTOR nor any subcontractor nor any person on their behalf shall in any manner discriminate against or intimidate any employee involved in the manufacture of supplies, the performance of work or any other activity required under the Contract on account of gender, race, creed or color.

23.3 The CONTRACTOR and any subcontractors shall establish and maintain a written sexual harassment policy and shall inform their employees of the policy. The policy must contain a notice that sexual harassment will not be tolerated and employees who practice it will be disciplined.

23.4 The CONTRACTOR shall not discriminate by reason of gender, race, creed, or color against any subcontractor or supplier who is qualified to perform the work to which the contract relates.

23.5 The CONTRACTOR and each subcontractor shall furnish all necessary employment documents and records to and permit access to its books, records, and accounts by the contracting officer and the Department of General Services' Bureau of Contract Administration and Business Development for purposes of investigation to ascertain compliance with the provisions of this Nondiscrimination/Sexual Harassment Clause. If the CONTRACTOR or any subcontractor does not possess documents or records reflecting the necessary information requested, it shall furnish such information on reporting forms supplied by the contracting officer or the Bureau of Contract Administration and Business Development.

23.6 The CONTRACTOR shall include the provisions of this Nondiscrimination/Sexual Harassment Clause in every subcontract so that such provisions will be binding upon each subcontractor.

23.7 The Commonwealth may cancel or terminate the Contract, and all money due or to become due under the Contract may be forfeited for a violation of the terms and conditions of this Nondiscrimination/Sexual Harassment Clause. In addition, the agency may proceed with debarment or suspension and may place the GRANTEE in the Contractor Responsibility File.

24. ANTI-POLLUTION LEGISLATION

24.1 On October 26, 1972, House Bill Number 1969 was enacted into law. This Act (No. 247) became effective on November 25, 1972. It requires that Bidders on construction contracts for the Commonwealth of Pennsylvania be advised of those provision of Federal and State statutes, rules and regulations dealing with the prevention of environmental pollution and the preservation of public natural resource that affect the Project on which bids are being received.

24.2 The Bidder shall thoroughly acquaint itself with the terms of the listed statutes, rules and regulations. No separate or additional payment will be made for such compliance. In the event that the listed statues, rules and regulations are amended or if new statutes, rule or regulations become effective after date of receipt of bids, upon receipt of documentation which causes the Contractor to perform additional work, the Owner may issue a change order or deviation request setting forth the additional work that must be undertaken. This change order or deviation request shall not invalidate the Contract.

24.3 It is the responsibility of the Contractor to determine what local ordinances, if any, will affect its work. They shall check for any county, city, borough or township rules or regulations applicable to the area in which the project is being constructed and, in addition, for any rules or regulations of other organizations having jurisdiction, such chambers-of-commerce, planning commissions, industries or utility companies who have jurisdiction over lands which the Contractor occupies. Any costs of compliance with local controls shall be included in the price bid, even though document of such local controlling agencies are not listed herein.

25. EROSION CONTROL

25.1 General Contractor shall comply with all rules and regulations of Chapter 102, Title 25 of Pennsylvania Soil Erosion and Sedimentation Control.

25.2 The plan shall be maintained at site and shall indicate how the Contractor plans to control erosion caused by storm water and prevent silt and sedimentation being distributed off site.

25.3 Control shall be provided by channels, dikes, sedimentation basins, protection of stockpiled or uncontrolled soil or any other means necessary, all in accordance with the requirements of the Pennsylvania Department of Environmental Resources.

26. PUBLIC WORKS CONSTRUCTION CONTRACTS

In consideration of the funds awarded and activities funded under this CONTRACT which involve construction, reconstruction, alteration, repair, improvement, or maintenance of a building, structure, or improvement ("The Work"), the CONTRACTOR agrees to perform in accordance with the following:

26.1 Steel Products Procurement Act. In the performance of any contract awarded for Work, the contract, subcontractors, materialmen, or suppliers shall use only steel products rolled, formed, shaped, drawn, extruded, forged, cast, fabricated, or otherwise similarly processed, or processed by a combination of two or more of such operations, from steel made in the United States by the open hearth, basic oxygen, electric furnace Bessemer, or other steel-making process. Steel products include not only cast iron products, but also machinery and equipment listed in United States Department of Commerce Standard Industrial Classifications 25 (furniture and fixtures), 35 (machinery, except electrical), and 37 (transportation equipment), and made of, fabricated from, or containing, steel components. If a product contains both foreign and United States steel, it shall be determined to be a United States steel product only if at least 75 percent of the cost of the articles, materials, and supplies have been mined, produced, or manufactured, as the case may be, in the United States. Transportation equipment shall be determined to be a United States steel product only if it complies with Section 165 of P.L. 97-424 (96 Stat. 2136).

When unidentified steel products are supplied under a contract for Work, before any payment will be made, the contractor must provide documentation including, but not limited to, invoices, bills of lading, and mill certification that the steel was melted and manufactured in the United States. If a steel product is identifiable from its face, the contractor must submit certification which satisfies the using agency that the contractor has fully complied with this provision. OB shall not provide for or make any payments to any person who has not complied with the Steel Products Procurement Act (hereinafter referred to as the "SPPA"). Any such payments made to any person by OB which should not have been made as a result of the SPPA shall be recoverable directly from the contractor, subcontractor, manufacturer, or supplier who did not comply with the SPPA.

In addition to withholding of payments, any person who willfully violates any of the provisions of the SPPA shall be prohibited from submitting any bids to any public agency for a period of FIVE (5) years from the date of the determination that a violation has occurred. In the event the person who violates the provisions of the SPPA is a subcontractor, manufacturer, or supplier, such person shall be prohibited from performing any work for, or supplying any materials to, a public agency for a period of FIVE (5) years from the date of the determination that a violation has occurred.

The CONTRACTOR shall include the provisions of the SPPA in every subcontract and supply contract so that the provisions of the SPPA shall be binding upon each subcontractor and supplier.

26.2 Trade Practices Act. In accordance with the Trade Practices Act of July 23, 1968, P.L. 686 (71 P.S. §773.101 et seq.), the CONTRACTOR cannot and shall not use or permit to be used in the Work any aluminum or steel products made in a foreign country which discriminates against aluminum or steel products manufactured in Pennsylvania. The countries of Argentina, Brazil, South Korea, and Spain have been found to discriminate against certain products manufactured in Pennsylvania. Therefore, the purchase or use of those countries products, as listed below, is not permitted.

26.2.1 Argentina: carbon steel wire rod and cold-rolled carbon steel sheet.

26.2.2 Brazil: welded carbon steel pipes and tubes; carbon steel wire rod; tool steel; certain stainless steel products, including hot-rolled stainless steel bar; stainless steel wire rod and cold-formed stainless steel bar; prestressed concrete steel wire strand; hot rolled carbon steel plate in coil; hot-rolled carbon steel sheet; and cold-rolled carbon steel sheet.

26.2.3 South Korea: welded carbon steel pipes and tubes; hot-rolled carbon steel plate; hot-rolled carbon steel sheet; and galvanized steel sheet.

26.2.4 Spain: certain stainless steel products, including stainless steel wire rod, hot-rolled stainless steel bars; and cold-formed stainless steel bars; prestressed concrete steel wire strand; and certain steel products, including hot-rolled steel plate, cold-rolled carbon steel plate, carbon steel structural shapes, galvanized carbon steel sheet, hot-rolled carbon steel bars, and cold-formed carbon steel bars.

Penalties for violation of the above paragraphs may be found in the Trade Practices Act, which penalties include becoming ineligible for public works contracts for a period of THREE (3) years.

This provision in no way relieves the CONTRACTOR of responsibility to comply with those provisions of this CONTRACT which prohibit the use of foreign-made steel and cast iron products.

26.3 Public Works Contractor's Bond Law of 1967. Prior to the award of any contract for any Work on the Project, the contractor to whom the contract is to be awarded must furnish the following bonds which shall become binding upon the award of such contract:

26.3.1 A performance bond at 100 percent of the contract amount, conditioned upon the faithful performance of the contract in accordance with the plans, specifications, and conditions of the contract. Such bond shall solely for the protection of the contracting body which awarded said contract.

26.3.2 A payment bond at 100 percent of the contract amount. Such bond shall be solely for the protection of claimants supplying labor or materials to the CONTRACTOR, its contractor or to any of its subcontractors, in the prosecution of the work provided for in such contract, and shall be conditioned for the prompt payment of all such material furnished or labor supplied or performed in the prosecution of the work. "Labor or materials" shall include public utility services and reasonable rentals of equipment, but only for periods when the equipment rented is actually used at the site.

26.4 Pennsylvania Prevailing Wage Act. The CONTRACTOR, its subgrantees, contractors and subcontractors shall comply with the provisions, duties, obligations, remedies, and penalties of the Pennsylvania Prevailing Wage Act, 42 P.S. § 165-1 et seq. which is incorporated herein by

reference as if fully set forth herein. The general prevailing minimum wage rates, as determined by the Secretary of Labor and Industry shall be paid for each craft or classification of all workmen needed to perform work on the Project during the term hereof for the locality in which the work is to be performed.

27. SEVEREABILITY

27.1 Should any section or any part of any section of this CONTRACT be rendered void, invalid, or unenforceable by any court of law, for any reason, such a determination shall not render void, invalid, or unenforceable any other section or part of any section of this CONTRACT.

28. AMERICANS WITH DISABILITIES ACT

During the term of this CONTRACT, the CONTRACTOR agrees as follows:

28.1 Pursuant to federal regulations promulgated under the authority of The Americans with Disabilities ACT, 28 C.F.R. § 35.101 et. Seq., the CONTRACTOR understands and agrees that no individual with a disability shall, on the basis of the disability, be excluded from participation in this CONTRACT or from activities provided for under this CONTRACT. As a condition of accepting and executing this CONTRACT, the CONTRACTOR agrees to comply with the General Prohibitions Against Discrimination, 28 C.F.R. § 35.130, and all other regulations promulgated under Title II of The Americans with Disabilities Act which are applicable to all benefits, services, programs, and activities provided by the OWNER through contracts.

28.2 The CONTRACTOR shall be responsible for and agrees to indemnify and hold harmless the OWNER from all losses, damages, expenses, claims, demands, suits, and actions brought by any party against the OWNER as a result of the CONTRACTOR failure to comply with provisions of paragraph A above.

29. HEALTH AND SAFETY

Bidders shall comply with the provisions of the Occupational Safety and Health Administration, Federal Act 91-596 of December 29, 1970, and with any other safety and health regulations for the jurisdiction in which the Work is performed.

30. BONDS AND INSURANCE

30.1 The Bidder will be required to furnish a Bid Bond, Performance Bond and Labor and Material Payment Bonds in the amount of one hundred percent (100%) of the Contract Price in the form provided in the Contract Documents. Said Sureties shall be listed on the current Federal Register and have an AM Best rating of ‘A-’ or better and a financial rating of Class X or higher.

30.2 Insurance companies must be rated ‘A-’ or better in A.M. Best.

30.3 Bidder shall include the cost of the Bonds & Insurance in their Bid.

30.4 Bidder shall provide the insurance required in the General Conditions.

31. PRE-BID CONFERENCE

The mandatory Pre-bid Conference will be held on the date and time listed on the Invitation to Bidders. Representatives of Owner and Architect will be present to discuss the Project. Architect will transmit to all prospective Bidders of record such Addenda, as Architect considers necessary in response to questions arising at the Conference. Non-attendees will not be permitted to bid.

32. ALTERNATES

All requested alternates as defined in Division 01 or the bid documents shall be bid. Provide prices for those alternates indicated on the Form of Proposal. Include changes to Contract Sum. Methods for bidding Alternates are as specified in Division 01.

32.1 The Bidder agrees to modify the base bid by the amounts stated for alternates as requested on the Bid Form and specified in the Bidding documents.

32.2 The Owner shall have the right to accept Alternates in the sequence or combinations listed and to determine the low Bidder on the basis of the sum of the Base Bid and the Alternates accepted.

32.3 Alternate work shall be completed within the same time frame as indicated on the Contract Documents for associated work. No alternate shall modify the project material allowances unless stated within the allowance description.

32.4 If there is no change in the contract amount for any alternate write NO CHANGE or ZERO (0) in the blank.

32.5 Enter the amount for each alternate on the line pre-marked as “ADD” or DEDUCT”. Where both the words “ADD and “DEDUCT” are provided for an alternate, strike through one of the words so that the appropriate word remains.

32.6 The failure to enter an amount in the blanks for an alternate shall be treated conclusively as a Bid of zero dollars for the work described in the alternate.

33. UNIT PRICES

Provide unit prices in accordance with requirements specified in the proposal/bid form and bidding documents. Unit costs will be used for adjustment of the Contract Sum if any are required. The Owner reserves the right to reject any unit prices bid.

34. ALLOWANCES

Include all allowances listed on the Bid Form and project drawings and specifications in the base bid price. Do not adjust allowances for any alternates unless specifically listed in the alternate.

35. PROJECT FINANCING

The work to be done under this Contract is public work and may be financed in whole or part by the Owner (a public body) by issuance of bonds or procurement of grants, which are subject to various qualifications and restrictions. The Owner, in such case and in good faith, intends to consummate such financing, but its ability to do so is subject to many factors beyond its control. It is therefore expressly understood and agreed to by each bidder that, notwithstanding any other provision of the Contract Documents, the Owner may at any time cancel any award made by it, or cancel any contract entered into with any bidder, without liability to the bidder, at any time before the bidder has been given written notice to proceed and has actually begun Work under the Contract if financing satisfactory to the Owner cannot reasonably be consummated as contemplated, or if any court of competent jurisdiction shall enjoin or otherwise prohibit the Owner from proceeding with the Work. The bidder shall have the right to cancel the Contract in accordance with the Pennsylvania Commonwealth Procurement Code, 62 Pa.C.S. § 3911.

END OF SECTION

SECTION 00.2625 – SUBSTITUTION REQUEST FORM

A. Submissions for approved substitutions will be permitted and processed in accord with Article 10 of Document 00 2113 “Instructions to Bidders”.

B. Submissions will be "received dated" immediately upon arrival at the office of Alloy5 Architecture.

C. All Submissions must be received ten (10) days prior to bid or they may not be reviewed.

D. Reviewer's General Criteria for review will be:
   1. Burden of proof of performance equality and completeness of this submittal is the responsibility of the submitter.
   2. Reviewers will not be required to complete the submittal, that is, select from options or between models and lines of products.
   3. Reviewer will not be required to seek information from the manufacturer's literature on file in the office, or information from other locations.
   4. Product must be equal, or better, in those features and performance which specified product provides.
   5. When in the reviewer's opinion, significant deficiencies are established, further review of submitted data is not required.

G. Reviewer will note action (approval or disapproval), the date, and their initials.

H. If a submittal is disapproved, reviewer will make notations that will be adequate to guide a later reviewer to the same conclusion. Sample notations may be: "Submittal vague", "incomplete", or "product equality not substantiated".

I. Submittals received after closing time will be "received dated," marked "late", initialed, and filed without review.

J. Submittals will be filed in the project file until completion of the project, then destroyed.

K. Approval of a substitute item will be communicated to bidders in the form of an Addendum.

TO:

ALLOY 5 ARCHITECTURE
530 W BROAD STREET

BETHLEHEM, PA 18018

PROJECT _____

PRIME BIDDER _____

CONTRACTOR/SUPPLIER _____

We hereby submit for consideration, the following product instead of specified item for above project:

SECTION/DRAWING	**PARAGRAPH/DETAIL**	**SPECIFIED ITEM**
_____	_____	_____

Proposed Substitution: _____

MANUFACTURER'S HOME OFFICE:

Address: _____

Telephone: _____

Contact: _____

LOCAL REPRESENTATIVE:

Address: _____

Telephone: _____

Contact: _____

Attached to this request is product data, specifications, performance tests and data, and color samples. The attached information also includes any modifications of the Contract Documents which would be required if this substitution is utilized for this Project.

The undersigned states that as a Prime Bidder on the above referenced Project the following statements are true.

1. The Prime Bidder has investigated proposed Product and determined that it meets or exceeds the quality level of the specified Product.
2. That the product manufacturer will provide the same warranty for the Substitution as for the specified Product.
3. That the use of this product will not have an adverse effect on any other trade or Prime Contractor or the Construction Schedule.
4. That the use of this product does not affect the dimensions shown on the Drawings unless specifically stated in the attached information.

Reason for Substitution**:** _____

_____

_____

_____

ATTACHMENTS *(If not applicable, write N/A in space provided)*

No. 1 Complete product data, including technical data and laboratory tests, if applicable.

_____

No. 2 Drawings indicating dimensional changes. _____

No 3. Complete description of changes to drawings and specifications which proposed substitution will require for its proper installation.

_____

No. 4 Necessary samples and substantiating data to prove equal quality, performance, and appearance to what which is specified. Clearly mark manufacturer's literature to indicate equality in performance. Difference in quality of materials and construction shall be indicated.

No. 5 List of names and addresses of three similar products on which product was used, date of installation, and Architect/Engineer's name, address, and telephone numbers.

_____
_____
_____

Fill in blanks below *(Provide attachments if more space is necessary)*

A. Does the substitution affect dimensions indicated on the Contract Drawings?
Yes_____ No_____ If yes, clearly indicate changes:

_____

B. Will the undersigned pay for changes to the building design, including engineering and detailing costs caused by the requested substitution?

_____

C. What effect does substitution have on other trades, other contracts, and Contract Complete date?

_____

D. What effect does substitution have on applicable code requirements?

_____

E. List the difference between proposed substitution and specified item:

_____
_____

F. Identify manufacturer's guarantees: _____
_____

G. Identify cost impact. Provide attachments showing proposed credit:

_____
_____

Undersigned attests function and quality equivalent or superior to specified item.

CERTIFICATION OF EQUAL PERFORMANCE:

Submitted by: _____Title: _____

Company: _____

Address: _____

Date: _____

Telephone: _____ E-mail: _____

Signature: _____

. . . . . .

For use by the Architect/Engineer:

Accepted: _____ Accepted as Noted: _____

Not Accepted: _____ Received Too Late: _____

Reviewer: _____ Date: _____

Remarks: _____

_____

_____

_____

END OF SECTION 00.2625

PROPOSAL FOR
BOROUGH OF CONSHOHOCKEN PUBLIC SAFETY BUILDING
GENERAL CONTRACTOR

Submitted To:

BOROUGH OF CONSHOHOCKEN

400 Fayette Street

Conshohocken, PA 19428

Submitted By:

_____

_____

_____

THIS BID FORM SHALL NOT BE ALTERED IN ANY MANNER. ANY ALTERED BID FORMS SHALL BE CONSIDERED NON-RESPONSIVE AND WILL BE REJECTED.

1. The undersigned BIDDER proposes and agrees, if this Bid is accepted, to enter into an Agreement with OWNER in the form included in the Contract Documents to complete all Work as specified or indicated in the Contract Documents for the Contract Price and within the Contract Time indicated in this Bid and in accordance with the Contract Documents.

2. BIDDER accepts all of the terms and conditions of the Instructions to Bidders, including without limitation, those dealing with disposition of Bid Security. This Bid will remain open for SIXTY (60) days after the day of Bid Opening. BIDDER will sign the Agreement and submit the Contract Security and other documents required by the Contract Documents within ten (10) days after the date of OWNER'S Notice of Award.

3. In submitting this Bid, BIDDER represents, as more fully set forth in the Agreement, that:

   a. BIDDER has examined copies of all Contract Documents, Advertisement to Bid, and the Instructions to Bidders. Additionally, the Bidder hereby acknowledges receipt of the following addenda:

      Addendum No. ____; ___ ; ___; ___

   b. BIDDER has examined the site and locality where the Work is to be performed, the legal requirements (federal, state, and local laws, ordinances, rules and regulations) and the conditions affecting cost, progress or performance of the Work and has made such independent investigations, as BIDDER deems necessary. Failure to visit the project site shall be no reason for future request for additional compensation or costs of any kind.

   c. This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, form, or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; BIDDER has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; BIDDER has not solicited or induced any person, firm or corporation to refrain from bidding; and BIDDER has not sought by collusion to obtain for himself any advantage over any other Bidder or OWNER.

4. The BIDDER agrees to perform the various items of Work for the following Lump Sum Prices:

Base Bid Price:

_____**Dollars.**
(Words)

($_____)
(Figures)

5. **ALTERNATES**: The Bidder agrees that the Owner shall have the right to accept or reject any or all of the following alternates, which acceptance or rejection shall enter into the determination of the low bidder. The bidder agrees that the contract time shall not be increased on account of the acceptance of any one or combination of alternates unless specifically stated in such Alternate descriptions. The Bidder agrees that the Owner shall have the right to accept an alternate that is higher in price than the base bid or other alternate. Alternates Prices shall include the cost of furnishing, installing all materials, labor, tools, equipment and other incidentals necessary to complete the work in accordance with the design intent, manufacturers' recommendations, building codes and the project specifications. Do not adjust material allowance under any alternate bid items. Indicate whether alternate price is an add or deduct when a choice is provided.

   ALTERNATE No. 1: The Bidder shall state the adjustment in price from the base bid should the owner decide to add Epoxy Flooring with integral base in Engine Bays 151 and EMS Bays 100 as indicated on drawings and specifications.

   ADD / DEDUCT_____Dollars.
   (Words)

   ($_____)
   (Figures)

   ALTERNATE No. 2: The Bidder shall state the adjustment in price from the base bid should the owner decide to DELETE limestone panels and all associated steel from the Terrace 200 and Terrace 209 walls and provide Metal Composite Material Wall Panels. See drawings A2.21 Enlarged Exterior Elevations for additional details.

   ADD / DEDUCT_____Dollars.
   (Words)

   ($_____)
   (Figures)

   ALTERNATE No. 3: The Bidder shall state the adjustment in price from the base bid should the owner decide to provide the architectural trellis. See civil drawings.

ADD / DEDUCT_____Dollars.
(Words)

($_____)
(Figures)

ALTERNATE No. 4: The Bidder shall state the adjustment in price to be added or deducted from the base bid should the owner decide to provide a second generator paralleled with the base bid generator. Include all associated gas piping, conduits, conductors, electrical distribution equipment, etc. See sheets E3.01, E3.03, E5.00, and P3.03. Provide all required structural steel and roof dunnage indicated on structural drawings and provide all required roof flashing at all penetrations.

ADD / DEDUCT_____Dollars.
(Words)

($_____)
(Figures)

ALTERNATE No. 5: The Bidder shall state the adjustment in price to be added or deducted from the base bid should the owner decide to DELETE three (3) flagpoles and associated components including in-grade lighting in the rear yard. See sheets A5.01 and SE1.00 for reference.

ADD / DEDUCT_____Dollars.
(Words)

($_____)
(Figures)

ALTERNATE No. 6: The Bidder shall state the adjustment in price to be added or deducted from the base bid should the owner decide to provide a 30-year fully adhered EPDM roof system by Carlisle Sytec, Firestone, Johns Manville, or Versico in lieu of the roofing system included in the base bid. See Specifications Section 075300.01

ADD / DEDUCT_____Dollars.
(Words)

($_____)
(Figures)

ALTERNATE No. 10: The Bidder shall state the adjustment in price to be added or deducted from the base bid should the owner decide to DELETE the two (2) concrete aprons near Harry Street and provide Heavy Duty Asphalt Pavement. See civil drawings Sheets 2 and 26 for reference

ADD / DEDUCT_____Dollars.
(Words)

($_____)
(Figures)

ALTERNATE No. 11: The Bidder shall state the adjustment in price to be added or deducted from the base bid should the owner decide to DELETE the replacement of unstable materials encountered with compacted 2A aggregate and provide replacement of unstable materials encountered with lean concrete.
ADD / DEDUCT_____Dollars.
(Words)

($_____)
(Figures)

ALTERNATE No. 7-9: **Not in GC scope**

6. **UNIT PRICES**: OWNER shall make adjustments to the Contract based on the actual field conditions encountered using the Unit Prices included with the proposal. The BIDDER agrees that OWNER reserves the right to reject or otherwise not agree to use the Unit Prices submitted, if in the Owners opinion, the nature or quantity of the Work encountered is such that the unit price cost no longer applies to the Work. **The responsiveness of the Bid and if the Bid is responsible, may be determined by the Owner on the basis of the Unit Prices proposed by the bidder. Unit Prices shall be consistent with verifiable average costs for the work to be performed. Bidders agree that a proposal may be rejected if the Unit Prices submitted are inconsistent with the average cost.** Under **NO** circumstances will BIDDER perform Unit Price Work without prior written authorization from OWNER. Unit Prices shall include costs for furnishing and installing all materials, labor, tools, equipment, and other incidental costs necessary to complete the specified operation. Unit prices will be used to ADD/DEDUCT the contract cost where appropriate. The Bidder agrees that in the event of any inconsistency between a Unit Price and the extension of a Unit Price in a Material Allowance, the Unit Price shall control, the Material Allowance extension shall be recalculated.

   UNIT PRICE 1: BIDDER agrees to excavate and legally dispose of rock encountered by ram hammer and replace with compacted 2A modified natural stone. All rock must be identified and measured in the field by the Construction Manager prior to and during removal. Rock shall be removed by hydraulic / mechanical means no blasting will be permitted.

   - The contract Unit Price for rock excavation by hydraulic / mechanical means, no blasting will be permitted up to 100 cubic yards in one contiguous area is: $_____per cubic yrd

UNIT PRICE 2: BIDDER agrees to excavate, remove and legally dispose off-site, unstable materials encountered and replace with compacted 2A modified natural stone. All removal must be identified and measured in situ by the Owner's representative.

- The contract Unit Price for unsuitable soil removal and replacement with compacted 2A modified natural stone up to 100 cubic yards in one defined contiguous area is: $_____per cubic. yds.

UNIT PRICE 4: BIDDER agrees to import additional structural fill material including the installation of the imported structural fill material including compaction and testing for the imported fill.

- The contract Unit Price per cubic yard to import additional structural fill material including the installation of the imported structural fill material including compaction and testing for the imported fill is: $_____per cubic yard

UNIT PRICE 5: BIDDER agrees to provide and install 3,000 psi concrete in footings including footing framework.

- The contract Unit Price per cubic yard to provide and install 3,000 psi concrete in footings including footing framework is:: $_____per cubic yard

UNIT PRICE 6: BIDDER agrees to furnish and install reinforcing bars, bent and installed.
The contract Unit Price per pound to furnish and install reinforcing bars, bent and installed is: $_____per pound

UNIT PRICE 7: BIDDER agrees to provide and install miscellaneous steel for lintels; floor and roof opening headers and miscellaneous angles, beams, plates, bars, etc. including fabrication, shop priming, and delivery to site.

- The contract Unit Price per ton to provide and install miscellaneous steel for lintels; floor and roof opening headers and miscellaneous angles, beams, plates, bars, etc. including fabrication, shop priming, and delivery to site is: $_____per ton

UNIT PRICE 8: BIDDER agrees to furnish and install additional miscellaneous fabricated and erected structural steel:
The contract Unit Price to furnish and install additional miscellaneous fabricated and erected structural steel per ton is: $_____per ton

UNIT PRICE 9: BIDDER agrees to install an additional 2' wide x 1' high bulkhead, soffit or chase with 3 5/8" metal stud framing and 5/8" thick mold resistant gypsum drywall including finishing and painting up to a maximum height of 10 feet above finished floor.

- The contract Unit Price to install an additional 2' wide x 1' high bulkhead, soffit or chase with 3 5/8" metal stud framing and 5/8" thick mold resistant gypsum drywall including finishing and painting up

to a maximum height of 10 feet above finished floor per linear foot is: $_____per linear foot

UNIT PRICE 10: BIDDER agrees to furnish and install bituminous asphalt paving including excavation and consisting of 6" stone base, 6" base course, and 2" wearing course along with tack coat and joint sealant

- The contract Unit Price to furnish and install bituminous asphalt paving including excavation and consisting of 6" stone base, 6" base course, and 2" wearing course per square yard is:

$_____per square yard

UNIT PRICE 11: BIDDER agrees to excavate, form and install new concrete curb on site at the following unit price.

- The contract Unit Price for installation of new concrete curb on site per linear foot is: $_____per linear ft.

UNIT PRICE 12: BIDDER agrees to furnish and install exterior concrete sidewalk or flatwork including excavation and consisting of 4" stone base and 4" concrete.

- The contract Unit Price to furnish and install exterior concrete sidewalk or flatwork including excavation and consisting of 4" stone base and 4" concrete per square foot is:

$_____per sq. ft.

UNIT PRICE 13: BIDDER agrees to provide a Laborer (Class 03) at the following unit price.

- The contract Unit Price to provide a Laborer (Class 03) per hour is: $_____per hour

UNIT PRICE 14: BIDDER agrees to provide a brick layer at the following unit price.

- The contract Unit Price to provide a brick layer per hour is: $_____per hour

UNIT PRICE 15: **:** BIDDER agrees to provide a cement finisher at the following unit price.

- The contract Unit Price to provide a cement finisher per hour is: $_____per hour

UNIT PRICE 16: BIDDER understands that the Project scope, schedule, and milestone completion dates will require strategic overtime work from various trades in order to expedite construction activities to meet the project schedule. The CPM schedule prepared by the GC, as well as field conditions and judgement, will be used to identify any required overtime.

Each Contractor will be required to assign the resources when it is determined by all Primes that overtime is required. All overtime must be approved in advance and monitored by the CM and will be based on the Unit Price listed below and deducted from the Allowance amount. **The Unit Price shall be for the difference in rate between regular time and overtime**:

- The contract Unit Price for overtime per hour to provide a Laborer (Class 03), **with the hourly rate being defined as the difference in rate between regular rate and overtime rate** is: $_____per hour

7. **PROJECT QUANTITY ALLOWANCES:**

The Architect must field measure and approve all allowance work prior to the Contractor performing the Work. Should the allowance amount be exceeded, the Contractor will be paid by Change Order addition at the Unit Price established for the related Work. Similarly, should the allowance used be less than the allowance amount, the Contractor will credit the Owner for the unused quantity in accordance with the related Unit Price by a Change Order credit.

BIDDER agrees to include in the Base Bid Price, in addition to the Work shown on the Drawings and Specifications the following:

General Contract		
QUANTITY ALLOWANCE #	QUANTITY	UNITS
Quantity Allowance 1	50	**cubic yards of Unit Price 1 Work.**
Quantity Allowance 2	50	**cubic yards of Unit Price 2 Work.**
Quantity Allowance 3	100	**cubic yards of Unit Price 3 Work.**
Quantity Allowance 4	100	**cubic yards of Unit Price 4 Work.**
Quantity Allowance 5	500	**cubic yards of Unit Price 5 Work.**
Quantity Allowance 6	500	**pounds of Unit Price 6 Work.**
Quantity Allowance 7	3	**tons of Unit Price 7 Work.**
Quantity Allowance 8	5	**tons of Unit Price 8 Work.**
Quantity Allowance 9	200	**linear feet of Unit Price 9 Work.**
Quantity Allowance 10	250	**square yards of Unit Price 10 Work.**
Quantity Allowance 11	100	**linear feet of Unit Price 11 Work.**
Quantity Allowance 12	250	**square feet of Unit Price 12 Work.**
Quantity Allowance 13	120	**hours of Unit Price 13 Work.**
Quantity Allowance 14	80	**hours of Unit Price 14 Work.**
Quantity Allowance 15	80	**hours of Unit Price 15 Work.**
Quantity Allowance 16	120	**Overtime hours of Unit Price 16 work**

8. Bidder accepts the provisions of the Agreement as to the liquidated damages in the event of failure to complete the Work by the dates and milestones defined in the contract documents.

9. In submitting this Bid, it is understood that the OWNER reserves the unrestricted right to reject any and all bids, or to waive any informalities or technicalities in said Bids.

10. Accompanying this Bid is Security in the form of_____ in the amount of ten percent (10%) of the total of the Base Bid and all possible add alternates.

In witness whereof, the undersigned has caused this Proposal to be executed this_____day of _____ 2026.

INDIVIDUAL, PARTNERSHIP OR CORPORATION

_____
(Firm Name)

By:_____
(Signature)

_____

Print or Type Name of Person Authorized to Sign _____Title

State of Incorporation _____

Business Address _____

_____

Telephone Number (_____) _____

Email Address _____

_____
Attest by

_____
Print or Type Name of Person

Corporate Seal

PROPOSAL FOR
BOROUGH OF CONSHOHOCKEN PUBLIC SAFETY BUILDING
MECHANICAL CONTRACTOR

Submitted To:

BOROUGH OF CONSHOHOCKEN

400 Fayette Street

Conshohocken, PA 19428

Submitted By:

_____

_____

_____

THIS BID FORM SHALL NOT BE ALTERED IN ANY MANNER. ANY ALTERED BID FORMS SHALL BE CONSIDERED NON-RESPONSIVE AND WILL BE REJECTED.

1. The undersigned BIDDER proposes and agrees, if this Bid is accepted, to enter into an Agreement with OWNER in the form included in the Contract Documents to complete all Work as specified or indicated in the Contract Documents for the Contract Price and within the Contract Time indicated in this Bid and in accordance with the Contract Documents.

2. BIDDER accepts all of the terms and conditions of the Instructions to Bidders, including without limitation, those dealing with disposition of Bid Security. This Bid will remain open for SIXTY (60) days after the day of Bid Opening. BIDDER will sign the Agreement and submit the Contract Security and other documents required by the Contract Documents within ten (10) days after the date of OWNER'S Notice of Award.

3. In submitting this Bid, BIDDER represents, as more fully set forth in the Agreement, that:

   a. BIDDER has examined copies of all Contract Documents, Advertisement to Bid, and the Instructions to Bidders. Additionally, the Bidder hereby acknowledges receipt of the following addenda:

      Addendum No. ____; ___ ; ___; ___

   b. BIDDER has examined the site and locality where the Work is to be performed, the legal requirements (federal, state, and local laws, ordinances, rules and regulations) and the conditions affecting cost, progress or performance of the Work and has made such independent investigations, as BIDDER deems necessary. Failure to visit the project site shall be no reason for future request for additional compensation or costs of any kind.

   c. This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, form, or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; BIDDER has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; BIDDER has not solicited or induced any person, firm or corporation to refrain from bidding; and BIDDER has not sought by collusion to obtain for himself any advantage over any other Bidder or OWNER.

4. The BIDDER agrees to perform the various items of Work for the following Lump Sum Prices:

Base Bid Price:

_____**Dollars.**
(Words)

($_____)
(Figures)

5. **ALTERNATES**: The Bidder agrees that the Owner shall have the right to accept or reject any or all of the following alternates, which acceptance or rejection shall enter into the determination of the low bidder. The bidder agrees that the contract time shall not be increased on account of the acceptance of any one or combination of alternates unless specifically stated in such Alternate descriptions. The Bidder agrees that the Owner shall have the right to accept an alternate that is higher in price than the base bid or other alternate. Alternates Prices shall include the cost of furnishing, installing all materials, labor, tools, equipment and other incidentals necessary to complete the work in accordance with the design intent, manufacturers' recommendations, building codes and the project specifications. Do not adjust material allowance under any alternate bid items. Indicate whether alternate price is an add or deduct when a choice is provided.

ALTERNATE No. 1,2,3,4,5,6,7,8, 10, 11: **Not in MC Scope**

ALTERNATE No. 9A: The Bidder shall state the adjustment in price to be added to or deducted from the base bid to provide the base bid Apparatus Bay vehicle exhaust Rail system manufactured by Plymovent for all bays in Engine Bays 151 & EMS Bays 100 as indicated on the contract documents. See Specification 23.23516

ADD / DEDUCT_____Dollars.
(Words)

($_____)
(Figures)

ALTERNATE No. 9B: The Bidder shall state the adjustment in price to be added to or deducted from the base bid to provide the base bid Apparatus Bay vehicle exhaust Rail system with relocated components from another facility manufactured by Plymovent for all bays in Engine Bays 151 & EMS Bays 100 as indicated on the contract documents. See sheet M1.01.

ADD / DEDUCT_____Dollars.
(Words)

($_____)
(Figures)

6. **UNIT PRICES**: OWNER shall make adjustments to the Contract based on the actual field conditions encountered using the Unit Prices included with the proposal. The BIDDER agrees that OWNER reserves the right to reject or otherwise not agree to use the Unit Prices submitted, if in the Owners opinion, the nature or quantity of the Work encountered is such that the unit price cost no longer applies to the Work. **The responsiveness of the Bid and if the Bid is responsible, may be determined by the Owner on the basis of the Unit Prices proposed by the bidder. Unit Prices shall be consistent with verifiable average costs for the work to be performed. Bidders agree that a proposal may be rejected if the Unit Prices submitted are inconsistent with the average cost.** Under **NO** circumstances will BIDDER perform Unit Price Work without prior written authorization from OWNER. Unit Prices shall include costs for furnishing and installing all materials, labor, tools, equipment, and other incidental costs necessary to complete the specified operation. Unit prices will be used to ADD/DEDUCT the contract cost where appropriate. The Bidder agrees that in the event of any inconsistency between a Unit Price and the extension of a Unit Price in a Material Allowance, the Unit Price shall control, the Material Allowance extension shall be recalculated.

UNIT PRICE 1: BIDDER agrees to furnish and install insulated galvanized sheet metal ductwork with acoustical liner including hangers and accessories at the following unit price.

- The contract Unit Price, per pound, to furnish and install insulated galvanized sheet metal ductwork with acoustical liner including hangers and accessories is: $_____per pound

UNIT PRICE 2: BIDDER agrees to furnish and install 12”x12" type B, dynamic fire damper at the following unit price.

- The contract Unit Price, per fire damper, to furnish and install 12”x12" type B, dynamic fire damper is: $_____per assembly.

UNIT PRICE 3: BIDDER agrees to provide additional 2” diameter Type-L copper hot water piping installed with insulation, hangers and connections, in accordance with applicable Division 23 Sections and Drawings for similar work at the following unit price.

- The contract Unit Price, per linear foot, to provide additional 2” diameter Type-L copper hot water piping installed with insulation, hangers and connections, in accordance with applicable Division 23 Sections and Drawings for similar work is: $_____per linear ft.

UNIT PRICE 4: BIDDER agrees to provide additional 3” diameter Schedule 40 steel hot water piping installed with insulation, hangers and connections, in accordance with applicable Division 23 Sections and Drawings for similar work at the following unit price.

- The contract Unit Price, per linear foot, to provide additional 2” diameter Schedule 40 steel hot water piping installed with insulation, hangers and connections, in accordance with applicable Division 23 Sections and Drawings for similar work is: $_____per linear ft.

UNIT PRICE 5: BIDDER agrees to furnish and install 1” ball valve at the following unit price.

- The contract Unit Price, per valve, to furnish and install 1” ball valve is:
  $_____per assembly

UNIT PRICE 6: BIDDER agrees to furnish and install 3” butterfly valve at the following unit price.

- The contract Unit Price, per valve, to furnish and install 3” butterfly valve is:
  $_____per assembly

UNIT PRICE 7: BIDDER agrees to provide a journeyman sheet metal worker at the following Unit Price.

- The contract Unit Price, per hour, to provide a journeyman sheet metal worker is:
  $_____per hour

UNIT PRICE 8: BIDDER agrees to provide a journeyman steamfitter (pipefitter) at the following Unit Price.

- The contract Unit Price, per hour, to provide a journeyman steamfitter (pipefitter) is:
  $_____per hour

UNIT PRICE 9: BIDDER understands that the Project scope, schedule, and milestone completion dates will require strategic overtime work from various trades in order to expedite construction activities to meet the project schedule. The CPM schedule prepared by the GC, as well as field conditions and judgement, will be used to identify any required overtime.
Each Contractor will be required to assign the resources when it is determined by all Primes that overtime is required. All overtime must be approved in advance and monitored by the CM and will be based on the Unit Price listed below and deducted from the Allowance amount. **The Unit Price shall be for the difference in rate between regular time and overtime**:

- The contract Unit Price for overtime per hour to provide a steamfitter (pipefitter**), with the hourly rate being defined as the difference in rate between regular rate and overtime rate is**:
  $_____per overtime hour.

7. **PROJECT QUANTITY ALLOWANCES:**

The Architect must field measure and approve all allowance work prior to the Contractor performing the Work. Should the allowance amount be exceeded, the Contractor will be paid by Change Order addition at the Unit Price established for the related Work. Similarly, should the allowance used be less than the allowance amount, the Contractor will credit the Owner for the unused quantity in accordance with the related Unit Price by a Change Order credit.

BIDDER agrees to include in the Base Bid Price, in addition to the Work shown on the Drawings and Specifications the following:

Mechanical Contract		
QUANTITY ALLOWANCE #	QUANTITY	UNITS
Quantity Allowance 1	500	**pounds of Unit Price 1 Work.**
Quantity Allowance 2	12	**assemblies of Unit Price 2 Work.**
Quantity Allowance 3	250	**linear feet of Unit Price 3 Work.**
Quantity Allowance 4	100	**linear feet of Unit Price 4 Work.**
Quantity Allowance 5	8	**assemblies of Unit Price 5 Work.**
Quantity Allowance 6	8	**assemblies Unit Price 6 Work.**
Quantity Allowance 7	120	**hours of Unit Price 7 Work.**
Quantity Allowance 8	120	**hours of Unit Price 8 Work.**
Quantity Allowance 9	80	**overtime hours of Unit Price 12 Work.**

8. Bidder accepts the provisions of the Agreement as to the liquidated damages in the event of failure to complete the Work by the dates and milestones defined in the contract documents.

9. In submitting this Bid, it is understood that the OWNER reserves the unrestricted right to reject any and all bids, or to waive any informalities or technicalities in said Bids.

10. Accompanying this Bid is Security in the form of _____ in the amount of ten percent (10%) of the total of the Base Bid and all possible add alternates.

In witness whereof, the undersigned has caused this Proposal to be executed this_____day of _____ 2026.

INDIVIDUAL, PARTNERSHIP OR CORPORATION

_____
(Firm Name)

By:_____
(Signature)

_____

Print or Type Name of Person Authorized to Sign _____Title

State of Incorporation _____

Business Address _____

_____

Telephone Number (_____) _____

Email Address _____

_____
Attest by

_____
Print or Type Name of Person

Corporate Seal

PROPOSAL FOR
BOROUGH OF CONSHOHOCKEN PUBLIC SAFETY BUILDING
PLUMBING CONTRACTOR

Submitted To:

BOROUGH OF CONSHOHOCKEN

400 Fayette Street

Conshohocken, PA 19428

Submitted By:

_____

_____

_____

THIS BID FORM SHALL NOT BE ALTERED IN ANY MANNER. ANY ALTERED BID FORMS SHALL BE CONSIDERED NON-RESPONSIVE AND WILL BE REJECTED.

1. The undersigned BIDDER proposes and agrees, if this Bid is accepted, to enter into an Agreement with OWNER in the form included in the Contract Documents to complete all Work as specified or indicated in the Contract Documents for the Contract Price and within the Contract Time indicated in this Bid and in accordance with the Contract Documents.

2. BIDDER accepts all of the terms and conditions of the Instructions to Bidders, including without limitation, those dealing with disposition of Bid Security. This Bid will remain open for SIXTY (60) days after the day of Bid Opening. BIDDER will sign the Agreement and submit the Contract Security and other documents required by the Contract Documents within ten (10) days after the date of OWNER'S Notice of Award.

3. In submitting this Bid, BIDDER represents, as more fully set forth in the Agreement, that:

   a. BIDDER has examined copies of all Contract Documents, Advertisement to Bid, and the Instructions to Bidders. Additionally, the Bidder hereby acknowledges receipt of the following addenda:

      Addendum No. _____;_____;_____;_____

   b. BIDDER has examined the site and locality where the Work is to be performed, the legal requirements (federal, state, and local laws, ordinances, rules and regulations) and the conditions affecting cost, progress or performance of the Work and has made such independent investigations, as BIDDER deems necessary. Failure to visit the project site shall be no reason for future request for additional compensation or costs of any kind.

   c. This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, form, or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; BIDDER has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; BIDDER has not solicited or induced any person, firm or corporation to refrain from bidding; and BIDDER has not sought by collusion to obtain for himself any advantage over any other Bidder or OWNER.

4. The BIDDER agrees to perform the various items of Work for the following Lump Sum Prices:

Base Bid Price:

_____**Dollars.**
(Words)

($_____)
(Figures)

5. **ALTERNATES**: The Bidder agrees that the Owner shall have the right to accept or reject any or all of the following alternates, which acceptance or rejection shall enter into the determination of the low bidder. The bidder agrees that the contract time shall not be increased on account of the acceptance of any one or combination of alternates unless specifically stated in such Alternate descriptions. The Bidder agrees that the Owner shall have the right to accept an alternate that is higher in price than the base bid or other alternate. Alternates Prices shall include the cost of furnishing, installing all materials, labor, tools, equipment and other incidentals necessary to complete the work in accordance with the design intent, manufacturers' recommendations, building codes and the project specifications. Do not adjust material allowance under any alternate bid items. Indicate whether alternate price is an add or deduct when a choice is provided.

   ALTERNATE No. 1,2,3,4,5,6,7,9, 10, 11: **Not in PC Scope**

   ALTERNATE No. 8: The Bidder shall state the adjustment in price to be added or deducted from the base bid should the owner decide to provide PEX-A manufactured by Uponor in lieu of the Base Bid specified steel and copper for all domestic water piping sized 2" and less in accordance with the Contract Documents. See specification 22.1116

   ADD / DEDUCT_____Dollars.
   (Words)

   ($_____)
   (Figures)

6. **UNIT PRICES**: OWNER shall make adjustments to the Contract based on the actual field conditions encountered using the Unit Prices included with the proposal. The BIDDER agrees that OWNER reserves the right to reject or otherwise not agree to use the Unit Prices submitted, if in the Owners opinion, the nature or quantity of the Work encountered is such that the unit price cost no longer applies to the Work. **The responsiveness of the Bid and if the Bid is responsible, may be determined by the Owner on the basis of the Unit Prices proposed by the bidder. Unit Prices shall be consistent with verifiable average costs for the work to be performed. Bidders agree that a proposal may be rejected if the Unit Prices submitted are inconsistent with the average cost.** Under **NO** circumstances will BIDDER perform Unit Price Work without prior written authorization from OWNER. Unit Prices shall include costs for furnishing and installing all materials, labor, tools, equipment, and other incidental costs necessary to complete the specified operation. Unit prices will be used to ADD/DEDUCT the contract cost where appropriate. The Bidder agrees that in the event of any inconsistency between a Unit Price and the extension of a Unit Price in a Material Allowance, the Unit Price shall control, the Material Allowance extension shall be recalculated.

UNIT PRICE 1: BIDDER agrees to excavate and legally dispose of rock encountered by ram hammer and replace with compacted 2A modified natural stone. All rock must be identified and measured in the field by the Construction Manager prior to and during removal. Rock shall be removed by hydraulic / mechanical means no blasting will be permitted.

- The contract Unit Price for rock excavation by hydraulic / mechanical means, no blasting will be permitted up to 100 cubic yards in one contiguous area is: $_____per cubic yrd

UNIT PRICE 2: Bidder agrees to install 3/4-inch Type L copper piping including hangers and insulation.

- The contract Unit Price for 3/4-inch Type L copper piping including hangers and insulation is:

: $_____per linear ft.

UNIT PRICE 3: Bidder agrees to install 1-¼-inch Type L copper piping including hangers and insulation.

- The contract Unit Price for 1-¼-inch Type L copper piping including hangers and insulation is:

$_____per linear ft.

UNIT PRICE 4: Bidder agrees to install 2-inch Type L copper piping including hangers and insulation.

- The contract Unit Price for 2-inch Type L copper piping including hangers and insulation is: $_____per linear ft.

UNIT PRICE 5: Bidder agrees to provide and install 2-inch ball valve assembly with insulation and handle extensions.

- The contract Unit Price to provide and install for 2-inch ball valve assembly is:

$_____per assembly

UNIT PRICE 6: Bidder agrees to provide and install 1-inch ball valve assembly with insulation and handle extensions.

- The contract Unit Price to provide and install for 1-inch ball valve assembly is:

$_____per assembly

UNIT PRICE 7: Bidder agrees to furnish and install new concealed pendant sprinkler head in finished ceiling areas with up to 20 feet of piping including hangers, armover or flexible drop and accessories.

- The contract Unit Price to furnish and install new concealed pendant sprinkler head in finished ceiling areas with up to 20 feet of piping including hangers, armover or flexible drop and accessories is:

$_____per assembly

UNIT PRICE 8: Bidder agrees to install 4-inch PVC piping below slab / grade including trenching and backfill.

The contract Unit Price for 4-inch PVC piping below slab / grade including trenching and backfill is: $_____per linear ft

UNIT PRICE 9: Bidder agrees to install 4-inch PVC piping above slab / grade including hangers and insulation.

- The contract Unit Price for 4-inch PVC piping above slab / grade including hangers and insulation is:

$_____per linear ft.

UNIT PRICE 10: Bidder agrees to furnish and install upright sprinkler head with guards in finished ceiling areas with up to 20 feet of piping including hangers and accessories.

- The contract Unit Price to furnish and install upright sprinkler head with guards in finished ceiling areas with up to 20 feet of piping including hangers and accessories is

$_____per assembly

UNIT PRICE 11: Bidder agrees to provide a journeyman plumber.

- The contract Unit Price to provide a journeyman plumber is:

$_____per hour

UNIT PRICE 12: Bidder understands that the Project scope, schedule, and milestone completion dates will require strategic overtime work from various trades in order to expedite construction activities to meet the project schedule. The CPM schedule prepared by the GC, as well as field conditions and judgement, will be used to identify any required overtime.
Each Contractor will be required to assign the resources when it is determined by all Primes that overtime is required. All overtime must be approved in advance and monitored by CM and will be based on the unit price listed below and deducted from the Allowance amount. The Unit Price shall be for the difference in rate between regular time and overtime:

- The contract Unit Price for overtime rate to provide a journeyman plumber for overtime per hour, with the hourly rate being defined as the difference in rate between regular rate and overtime rate is:

$_____per overtime hour

7. **PROJECT QUANTITY ALLOWANCES:**

The Architect must field measure and approve all allowance work prior to the Contractor performing the Work. Should the allowance amount be exceeded, the Contractor will be paid by Change Order addition at the Unit Price established for the related Work. Similarly, should the allowance used be less than the allowance amount, the Contractor will credit the Owner for the unused quantity in accordance with the related Unit Price by a Change Order credit.

BIDDER agrees to include in the Base Bid Price, in addition to the Work shown on the Drawings and Specifications the following:

Plumbing Contract		
QUANTITY ALLOWANCE #	QUANTITY	UNITS
Quantity Allowance 1	50	**cubic yards of Unit Price 1 Work.**
Quantity Allowance 2	20	**linear feet of Unit Price 2 Work.**
Quantity Allowance 3	20	**linear feet of Unit Price 3 Work.**
Quantity Allowance 4	20	**linear feet of Unit Price 4 Work.**
Quantity Allowance 5	5	**assemblies of Unit Price 5 Work.**
Quantity Allowance 6	5	**assemblies Unit Price 6 Work.**
Quantity Allowance 7	15	**assemblies Unit Price 7 Work.**

Quantity Allowance 8	25	**linear feet of Unit Price 8 Work.**
Quantity Allowance 9	25	**linear feet of Unit Price 9 Work.**
Quantity Allowance 10	10	**assemblies of Unit Price 10 Work.**
Quantity Allowance 11	120	**hours of Unit Price 11 Work.**
Quantity Allowance 12	80	**overtime hours of Unit Price 12 Work.**

8. Bidder accepts the provisions of the Agreement as to the liquidated damages in the event of failure to complete the Work by the dates and milestones defined in the contract documents.

9. In submitting this Bid, it is understood that the OWNER reserves the unrestricted right to reject any and all bids, or to waive any informalities or technicalities in said Bids.

10. Accompanying this Bid is Security in the form of _____ in the amount of ten percent (10%) of the total of the Base Bid and all possible add alternates.

In witness whereof, the undersigned has caused this Proposal to be executed this_____day of _____ 2026.

INDIVIDUAL, PARTNERSHIP OR CORPORATION

_____
(Firm Name)

By _____
(Signature)

_____

Print or Type Name of Person Authorized to Sign _____Title

State of Incorporation _____

Business Address _____

_____

Telephone Number (_____) _____

Email Address _____

_____

Attest by

_____

Print or Type Name of Person

Corporate Seal

PROPOSAL FOR
BOROUGH OF CONSHOHOCKEN PUBLIC SAFETY BUILDING
ELECTRICAL CONTRACTOR

Submitted To:

BOROUGH OF CONSHOHOCKEN

400 Fayette Street

Conshohocken, PA 19428

Submitted By:

_____

_____

_____

THIS BID FORM SHALL NOT BE ALTERED IN ANY MANNER. ANY ALTERED BID FORMS SHALL BE CONSIDERED NON-RESPONSIVE AND WILL BE REJECTED.

1. The undersigned BIDDER proposes and agrees, if this Bid is accepted, to enter into an Agreement with OWNER in the form included in the Contract Documents to complete all Work as specified or indicated in the Contract Documents for the Contract Price and within the Contract Time indicated in this Bid and in accordance with the Contract Documents.

2. BIDDER accepts all of the terms and conditions of the Instructions to Bidders, including without limitation, those dealing with disposition of Bid Security. This Bid will remain open for SIXTY (60) days after the day of Bid Opening. BIDDER will sign the Agreement and submit the Contract Security and other documents required by the Contract Documents within ten (10) days after the date of OWNER'S Notice of Award.

3. In submitting this Bid, BIDDER represents, as more fully set forth in the Agreement, that:

   a. BIDDER has examined copies of all Contract Documents, Advertisement to Bid, and the Instructions to Bidders. Additionally, the Bidder hereby acknowledges receipt of the following addenda:

      Addendum No. _____;_____;_____;_____

   b. BIDDER has examined the site and locality where the Work is to be performed, the legal requirements (federal, state, and local laws, ordinances, rules and regulations) and the conditions affecting cost, progress or performance of the Work and has made such independent investigations, as BIDDER deems necessary. Failure to visit the project site shall be no reason for future request for additional compensation or costs of any kind.

   c. This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, form, or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; BIDDER has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; BIDDER has not solicited or induced any person, firm or corporation to refrain from bidding; and BIDDER has not sought by collusion to obtain for himself any advantage over any other Bidder or OWNER.

4. The BIDDER agrees to perform the various items of Work for the following Lump Sum Prices:

Base Bid Price:

_____**Dollars.**
(Words)

($_____)
(Figures)

5. **ALTERNATES**: The Bidder agrees that the Owner shall have the right to accept or reject any or all of the following alternates, which acceptance or rejection shall enter into the determination of the low bidder. The bidder agrees that the contract time shall not be increased on account of the acceptance of any one or combination of alternates unless specifically stated in such Alternate descriptions. The Bidder agrees that the Owner shall have the right to accept an alternate that is higher in price than the base bid or other alternate. Alternates Prices shall include the cost of furnishing, installing all materials, labor, tools, equipment and other incidentals necessary to complete the work in accordance with the design intent, manufacturers' recommendations, building codes and the project specifications. Do not adjust material allowance under any alternate bid items. Indicate whether alternate price is an add or deduct when a choice is provided.

   ALTERNATE No. 4: The Bidder shall state the adjustment in price to be added or deducted from the base bid should the owner decide to provide a second generator paralleled with the base bid generator. Include all associated gas piping, conduits, conductors, electrical distribution equipment, etc. See sheets E3.01, E3.03, E5.00, and P3.03. Provide all required structural steel and roof dunnage indicated on structural drawings and provide all required roof flashing at all penetrations.

   ADD / DEDUCT_____Dollars.
   (Words)

   ($_____)
   (Figures)

   ALTERNATE No. 5: The Bidder shall state the adjustment in price to be added or deducted from the base bid should the owner decide to DELETE three (3) flagpoles and associated components including in-grade lighting in the rear yard. See sheets A5.01 and SE1.00 for reference.

   ADD / DEDUCT_____Dollars.
   (Words)

   ($_____)
   (Figures)

ALTERNATE No. 7: The Bidder shall state the adjustment in price to be added or deducted from the base bid should the owner decide to provide a system as manufactured by Potter in-lieu of one of the listed manufacturers. See specification 28.4600.

ADD / DEDUCT_____Dollars.
(Words)

($_____)
(Figures)

ALTERNATE No. 1,2,3,6,8,9, 10, 11: **- NOT IN EC SCOPE**

6. **UNIT PRICES**: OWNER shall make adjustments to the Contract based on the actual field conditions encountered using the Unit Prices included with the proposal. The BIDDER agrees that OWNER reserves the right to reject or otherwise not agree to use the Unit Prices submitted, if in the Owners opinion, the nature or quantity of the Work encountered is such that the unit price cost no longer applies to the Work. **The responsiveness of the Bid and if the Bid is responsible, may be determined by the Owner on the basis of the Unit Prices proposed by the bidder. Unit Prices shall be consistent with verifiable average costs for the work to be performed. Bidders agree that a proposal may be rejected if the Unit Prices submitted are inconsistent with the average cost.** Under **NO** circumstances will BIDDER perform Unit Price Work without prior written authorization from OWNER. Unit Prices shall include costs for furnishing and installing all materials, labor, tools, equipment, and other incidental costs necessary to complete the specified operation. Unit prices will be used to ADD/DEDUCT the contract cost where appropriate. The Bidder agrees that in the event of any inconsistency between a Unit Price and the extension of a Unit Price in a Material Allowance, the Unit Price shall control, the Material Allowance extension shall be recalculated.

   UNIT PRICE 1: BIDDER agrees to excavate and legally dispose of rock encountered by ram hammer and replace with compacted 2A modified natural stone. All rock must be identified and measured in the field by the Construction Manager prior to and during removal. Rock shall be removed by hydraulic / mechanical means no blasting will be permitted.

   - The contract Unit Price for rock excavation by hydraulic / mechanical means, no blasting will be permitted up to 100 cubic yards in one contiguous area is: $_____per cubic yrd

   UNIT PRICE 2: Bidder agrees to furnish and install 100 lineal feet of 2-1/2" conduit, including (4) #4/0 conductors with #4 ground.
   - The contract Unit Price to furnish and install 100 lineal feet of 2-1/2" conduit, including (4) #4/0 conductors with #4 ground per linear foot:

     $_____per linear foot.

UNIT PRICE 3: Bidder agrees to furnish and install a 250V 100 Amp, 3-pole electrical fused switch assembly with 100A fuses and 200 feet of (4) #1, (1) #8 ground in 2" EMT conduit.

- The contract Unit Price to furnish and install a 250V 100 Amp, 3-pole electrical fused switch assembly with 100A fuses and 200 feet of (4) #1, (1) #8 ground in 2" EMT conduit per switch is:

$_____per switch

UNIT PRICE 4: Bidder agrees to furnish and install a 250V 60 Amp, 3-pole electrical fused switch assembly with 60A fuses and 200 feet of (4) #4, (1) #10 ground in 1-1/4" EMT conduit.

- The contract Unit Price to furnish and install a 250V 60 Amp, 3-pole electrical fused switch assembly with 60A fuses and 200 feet of (4) #4, (1) #10 ground in 1-1/4" EMT conduit per switch is:

$_____per switch

UNIT PRICE 5: Bidder agrees to furnish and install additional duplex receptacle and 20A circuit, including 20/1 circuit breaker, box, faceplate and 100' one-way circuit distance consisting of (2) #12, (1) #12 ground in ¾" conduit.

- The contract Unit Price to provide an additional duplex receptacle and 20A circuit, including 20/1 circuit breaker, accessories and wiring per outlet is: $_____per outlet

UNIT PRICE 6: Bidder agrees to furnish and install an additional Type 'B2' light fixture with 30 feet of circuiting, hung in place, with any accessories.

- The contract Unit Price to provide an additional Type 'B2' light fixture with 30 feet of circuiting, hung in place, with any accessories is: $_____per fixture

UNIT PRICE 7: Bidder agrees to furnish and install an additional exit sign assembly luminaire Type 'X', including mounting equipment, up to 100' of wiring consisting of (2) #10, (1) #10 ground in ¾" conduit, with appropriate terminations and connections.

- The contract Unit Price to provide an additional Type 'X' exit sign assembly and accessories is

: $_____per fixture

UNIT PRICE 8: **:** Bidder agrees to furnish and install an additional wall-mounted fire alarm audio / visual device assembly consisting of pull station device, backbox, cabling, conduit, necessary wall penetration cutting and patching, terminations, connections to fire alarm system, required programming, and 200 feet of wiring.

- The contract Unit Price to provide an additional wall-mounted fire alarm audio / visual device assembly consisting of pull station device, backbox, cabling, conduit, necessary wall penetration cutting and patching, terminations, connections to fire alarm system, required programming, and 200 feet of wiring is: $_____per device

UNIT PRICE 9: Bidder agrees to provide and install additional smoke detector device including 200 feet of wiring and accessories.

- The contract Unit Price to provide and install an additional smoke detector including 200 feet of wiring and accessories is: $_____per device

UNIT PRICE 10 Bidder agrees to install 50 linear feet of ¾" EMT conduit and junction box for Owner-provided security camera.
The contract Unit Price to install 50 linear feet of ¾" EMT conduit and junction box for Owner-provided security camera is: $_____per unit

UNIT PRICE 11: Bidder agrees to provide a journeyman electrician at the following unit price:

- The contract unit price to provide a journeyman electrician per hour is: $_____per hour

UNIT PRICE 12: Bidder understands that the Project scope, schedule, and milestone completion dates will require strategic overtime work from various trades in order to expedite construction activities to meet the project schedule. The CPM schedule prepared by the GC, as well as field conditions and judgement, will be used to identify any required overtime.
Each Contractor will be required to assign the resources when it is determined by all Primes that overtime is required. All overtime must be approved in advance and monitored by CM and will be based on the Unit Price listed below and deducted from the Allowance amount. **The Unit Price shall be for the difference in rate between regular time and overtime:**

- The contract Unit Price for overtime rate to provide a journeyman electrician for overtime per hour**, with the hourly rate being defined as the difference in rate between regular rate and overtime rate is**: $_____per overtime hour

7. PROJECT QUANTITY ALLOWANCES:

The Architect must field measure and approve all allowance work prior to the Contractor performing the Work. Should the allowance amount be exceeded, the Contractor will be paid by Change Order addition at the Unit Price established for the related Work. Similarly, should the allowance used be less than the allowance amount, the Contractor will credit the Owner for the unused quantity in accordance with the related Unit Price by a Change Order credit.

BIDDER agrees to include in the Base Bid Price, in addition to the Work shown on the Drawings and Specifications the following:

Electrical Contract		
QUANTITY ALLOWANCE #	QUANTITY	UNITS
Quantity Allowance 1	50	**cubic yards of Unit Price 1 Work.**
Quantity Allowance 2	300	**linear feet of Unit Price 2 Work.**
Quantity Allowance 3	2	**switches of Unit Price 3 Work.**
Quantity Allowance 4	2	**switches of Unit Price 4 Work.**
Quantity Allowance 5	15	**outlets of Unit Price 5 Work.**
Quantity Allowance 6	5	**fixtures Unit Price 6 Work.**
Quantity Allowance 7	8	**fixtures Unit Price 7 Work.**
Quantity Allowance 8	4	**devices Unit Price 8 Work.**
Quantity Allowance 9	4	**devices of Unit Price 9 Work.**

Quantity Allowance 10	4	**units of Unit Price 10 Work.**
Quantity Allowance 11	120	**hours of Unit Price 11 Work.**
Quantity Allowance 12	80	**overtime hours of Unit Price 12 Work.**

8. Bidder accepts the provisions of the Agreement as to the liquidated damages in the event of failure to complete the Work by the dates and milestones defined in the contract documents.

9. In submitting this Bid, it is understood that the OWNER reserves the unrestricted right to reject any and all bids, or to waive any informalities or technicalities in said Bids.

10. Accompanying this Bid is Security in the form of _____ in the amount of ten percent (10%) of the total of the Base Bid and all possible add alternates.

In witness whereof, the undersigned has caused this Proposal to be executed this_____day of _____ 2026.

INDIVIDUAL, PARTNERSHIP OR CORPORATION

_____
(Firm Name)

By _____
(Signature)

_____

Print or Type Name of Person Authorized to Sign _____Title

State of Incorporation _____

Business Address _____

_____

Telephone Number (_____) _____

Email Address _____

_____
Attest by

_____
Print or Type Name of Person

Corporate Seal

PROPOSAL FOR
BOROUGH OF CONSHOHOCKEN PUBLIC SAFETY BUILDING
TRAFFIC SIGNAL MODERNIZATION CONTRACTOR

Submitted To:

BOROUGH OF CONSHOHOCKEN

400 Fayette Street

Conshohocken, PA 19428

Submitted By:

_____

_____

_____

THIS BID FORM SHALL NOT BE ALTERED IN ANY MANNER. ANY ALTERED BID FORMS SHALL BE CONSIDERED NON-RESPONSIVE AND WILL BE REJECTED.

1. The undersigned BIDDER proposes and agrees, if this Bid is accepted, to enter into an Agreement with OWNER in the form included in the Contract Documents to complete all Work as specified or indicated in the Contract Documents for the Contract Price and within the Contract Time indicated in this Bid and in accordance with the Contract Documents.

2. BIDDER accepts all of the terms and conditions of the Instructions to Bidders, including without limitation, those dealing with disposition of Bid Security. This Bid will remain open for SIXTY (60) days after the day of Bid Opening. BIDDER will sign the Agreement and submit the Contract Security and other documents required by the Contract Documents within ten (10) days after the date of OWNER'S Notice of Award.

3. In submitting this Bid, BIDDER represents, as more fully set forth in the Agreement, that:

   a. BIDDER has examined copies of all Contract Documents, Advertisement to Bid, and the Instructions to Bidders. Additionally, the Bidder hereby acknowledges receipt of the following addenda:

      Addendum No. _____;_____;_____;_____

   b. BIDDER has examined the site and locality where the Work is to be performed, the legal requirements (federal, state, and local laws, ordinances, rules and regulations) and the conditions affecting cost, progress or performance of the Work and has made such independent investigations, as BIDDER deems necessary. Failure to visit the project site shall be no reason for future request for additional compensation or costs of any kind.

   c. This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, form, or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; BIDDER has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; BIDDER has not solicited or induced any person, firm or corporation to refrain from bidding; and BIDDER has not sought by collusion to obtain for himself any advantage over any other Bidder or OWNER.

4. The BIDDER agrees to perform the various items of Work for the following Lump Sum Prices:

Base Bid Price:

_____**Dollars.**
(Words)

($_____)
(Figures)

5. **ALTERNATES**: The Bidder agrees that the Owner shall have the right to accept or reject any or all of the following alternates, which acceptance or rejection shall enter into the determination of the low bidder. The bidder agrees that the contract time shall not be increased on account of the acceptance of any one or combination of alternates unless specifically stated in such Alternate descriptions. The Bidder agrees that the Owner shall have the right to accept an alternate that is higher in price than the base bid or other alternate. Alternates Prices shall include the cost of furnishing, installing all materials, labor, tools, equipment and other incidentals necessary to complete the work in accordance with the design intent, manufacturers' recommendations, building codes and the project specifications. Do not adjust material allowance under any alternate bid items. Indicate whether alternate price is an add or deduct when a choice is provided.

   ALTERNATE No. 1,2,3,4,5,6,7,8,9: **Not in TRAFFIC SIGNAL MODERIZATION Scope**

6. **UNIT PRICES**: OWNER shall make adjustments to the Contract based on the actual field conditions encountered using the Unit Prices included with the proposal. The BIDDER agrees that OWNER reserves the right to reject or otherwise not agree to use the Unit Prices submitted, if in the Owners opinion, the nature or quantity of the Work encountered is such that the unit price cost no longer applies to the Work. **The responsiveness of the Bid and if the Bid is responsible, may be determined by the Owner on the basis of the Unit Prices proposed by the bidder. Unit Prices shall be consistent with verifiable average costs for the work to be performed. Bidders agree that a proposal may be rejected if the Unit Prices submitted are inconsistent with the average cost.** Under **NO** circumstances will BIDDER perform Unit Price Work without prior written authorization from OWNER. Unit Prices shall include costs for furnishing and installing all materials, labor, tools, equipment, and other incidental costs necessary to complete the specified operation. Unit prices will be used to ADD/DEDUCT the contract cost where appropriate. The Bidder agrees that in the event of any inconsistency between a Unit Price and the extension of a Unit Price in a Material Allowance, the Unit Price shall control, the Material Allowance extension shall be recalculated.

7. **PROJECT QUANTITY ALLOWANCES:**

   The Architect must field measure and approve all allowance work prior to the Contractor performing the Work. Should the allowance amount be exceeded, the Contractor will be paid by Change Order addition at the Unit Price established for the related Work. Similarly, should the allowance used be less than the allowance amount, the Contractor will credit the Owner for the unused quantity in accordance with the related Unit Price by a Change Order credit.

   BIDDER agrees to include in the Base Bid Price, in addition to the Work shown on the Drawings and Specifications the following:

8. Bidder accepts the provisions of the Agreement as to the liquidated damages in the event of failure to complete the Work by the dates and milestones defined in the contract documents.

9. In submitting this Bid, it is understood that the OWNER reserves the unrestricted right to reject any and all bids, or to waive any informalities or technicalities in said Bids.

10. Accompanying this Bid is Security in the form of _____ in the amount of ten percent (10%) of the total of the Base Bid and all possible add alternates.

In witness whereof, the undersigned has caused this Proposal to be executed this_____day of _____ 2026.

INDIVIDUAL, PARTNERSHIP OR CORPORATION

_____
(Firm Name)

By _____
(Signature)

_____

Print or Type Name of Person Authorized to Sign _____Title

State of Incorporation _____

Business Address _____

_____

Telephone Number (_____) _____

Email Address _____

_____

Attest by

_____

Print or Type Name of Person

Corporate Seal

BID SECURITY

The Bid Security utilized for this project shall be a "Bid Bond", AIA Document A 310-2010, (draft copy included herein). This document may be purchased directly from the American Institute of Architects at 800-365-2724. Reference the Instructions to Bidders for the execution of this document.

PERFORMANCE BOND AND PAYMENT BOND

The "Performance Bond and Payment Bond", AIA Document A 312-2010, (draft copy included herein) shall be utilized for this project. These documents may be reviewed at the Architect's office. An original copy of this document will be presented to the bidder for execution upon notification. Reference the Instructions to Bidders for the execution of this document.

END OF SECTION 00.4300

DRAFT

AIA® Document A310™ – 2010

Bid Bond

CONTRACTOR:
(Name, legal status and address)

« »« »
« »

SURETY:
(Name, legal status and principal place of business)

« »« »
« »

OWNER:
(Name, legal status and address)

« »« »
« »

BOND AMOUNT: $ « »

PROJECT:
(Name, location or address, and Project number, if any)

« »
« »
« »

The Contractor and Surety are bound to the Owner in the amount set forth above, for the payment of which the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein. The conditions of this Bond are such that if the Owner accepts the bid of the Contractor within the time specified in the bid documents, or within such time period as may be agreed to by the Owner and Contractor, and the Contractor either (1) enters into a contract with the Owner in accordance with the terms of such bid, and gives such bond or bonds as may be specified in the bidding or Contract Documents, with a surety admitted in the jurisdiction of the Project and otherwise acceptable to the Owner, for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) pays to the Owner the difference, not to exceed the amount of this Bond, between the amount specified in said bid and such larger amount for which the Owner may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect. The Surety hereby waives any notice of an agreement between the Owner and Contractor to extend the time in which the Owner may accept the bid. Waiver of notice by the Surety shall not apply to any extension exceeding sixty (60) days in the aggregate beyond the time for acceptance of bids specified in the bid documents, and the Owner and Contractor shall obtain the Surety's consent for an extension beyond sixty (60) days.

If this Bond is issued in connection with a subcontractor's bid to a Contractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Project, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

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User Notes: (1800228952)

Signed and sealed this « » day of « » , « »

	« »
	(Contractor as Principal) *(Seal)*
	« »
(Witness)	*(Title)*
	« »
	(Surety) *(Seal)*
	« »
(Witness)	*(Title)*

DRAFT

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User Notes: (1800228952)

DRAFT AIA® Document A312® – 2010

Payment Bond

CONTRACTOR:
(Name, legal status and address)

« »« »
« »

SURETY:
(Name, legal status and principal place of business)

« »« »
« »

OWNER:
(Name, legal status and address)

« »« »
« »

CONSTRUCTION CONTRACT
Date: « »
Amount: $ « »
Description:
(Name and location)

« »
« »

BOND
Date:
(Not earlier than Construction Contract Date)
« »
Amount: $ « »
Modifications to this Bond: « » None « » See Section 18

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:	« »« »	Name and Title:	« »« »

(Any additional signatures appear on the last page of this Payment Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or **BROKER:**

« »
« »
« »

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

« »
« »
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ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

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§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

§ 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Section 13) of claims, demands, liens or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety.

§ 4 When the Owner has satisfied the conditions in Section 3, the Surety shall promptly and at the Surety's expense defend, indemnify and hold harmless the Owner against a duly tendered claim, demand, lien or suit.

§ 5 The Surety's obligations to a Claimant under this Bond shall arise after the following:

§ 5.1 Claimants, who do not have a direct contract with the Contractor,

- **.1** have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
- **.2** have sent a Claim to the Surety (at the address described in Section 13).

§ 5.2 Claimants, who are employed by or have a direct contract with the Contractor, have sent a Claim to the Surety (at the address described in Section 13).

§ 6 If a notice of non-payment required by Section 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Section 5.1.1.

§ 7 When a Claimant has satisfied the conditions of Sections 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

§ 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

§ 7.2 Pay or arrange for payment of any undisputed amounts.

§ 7.3 The Surety's failure to discharge its obligations under Section 7.1 or Section 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Section 7.1 or Section 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

§ 8 The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Section 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 9 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

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§ 10 The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to, or give notice on behalf of, Claimants or otherwise have any obligations to Claimants under this Bond.

§ 11 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 12 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Section 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 13 Notice and Claims to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

§ 14 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 15 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

§ 16 Definitions

§ 16.1 Claim. A written statement by the Claimant including at a minimum:

- **.1** the name of the Claimant;
- **.2** the name of the person for whom the labor was done, or materials or equipment furnished;
- **.3** a copy of the agreement or purchase order pursuant to which labor, materials or equipment was furnished for use in the performance of the Construction Contract;
- **.4** a brief description of the labor, materials or equipment furnished;
- **.5** the date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
- **.6** the total amount earned by the Claimant for labor, materials or equipment furnished as of the date of the Claim;
- **.7** the total amount of previous payments received by the Claimant; and
- **.8** the total amount due and unpaid to the Claimant for labor, materials or equipment furnished as of the date of the Claim.

§ 16.2 Claimant. An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

§ 16.3 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

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User Notes: (1768058448)

§ 16.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 16.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 17 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 18 Modifications to this bond are as follows:

« »

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:	« »« »	Name and Title:	« »« »
Address:	« »	Address:	« »

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User Notes: (1768058448)

DRAFT

AIA® Document A312® – 2010

Performance Bond

CONTRACTOR:
(Name, legal status and address)

« »« »
« »

SURETY:
(Name, legal status and principal place of business)

« »« »
« »

OWNER:
(Name, legal status and address)

« »« »
« »

CONSTRUCTION CONTRACT
Date: « »
Amount: $ « »
Description:
(Name and location)

« »
« »

BOND
Date:
(Not earlier than Construction Contract Date)
« »
Amount: $ « »
Modifications to this Bond: **« »** None **« »** See Section 16

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:	« »« »	Name and Title:	« »« »

(Any additional signatures appear on the last page of this Performance Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or **BROKER:**

« »
« »
« »

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

« »
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ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

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User Notes: (1697992822)

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Section 3.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after

.1 the Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Section 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;

.2 the Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

.3 the Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

§ 4 Failure on the part of the Owner to comply with the notice requirement in Section 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

§ 5 When the Owner has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

§ 5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

§ 5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

§ 5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

§ 5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

§ 6 If the Surety does not proceed as provided in Section 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

§ 7 If the Surety elects to act under Section 5.1, 5.2 or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the

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Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

.2 additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and

.3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

§ 8 If the Surety elects to act under Section 5.1, 5.3 or 5.4, the Surety's liability is limited to the amount of this Bond.

§ 9 The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors and assigns.

§ 10 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 11 Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

§ 13 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 14 Definitions

§ 14.1 Balance of the Contract Price. The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

§ 14.2 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

§ 14.3 Contractor Default. Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

§ 14.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 14.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 15 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

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§ 16 Modifications to this bond are as follows:

« »

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:	« »« »	Name and Title:	« »« »
Address:	« »	Address:	« »

DRAFT

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NON-COLLUSION AFFIDAVIT

State of _____:

SS

County of _____:

I state that I am_____ of _____
(Title) (Name of Firm)

and that I am authorized to make this Affidavit on behalf of my firm, and its Owners, Directors and Officers. I am the person responsible in my firm for the price(s) and the amount of this Bid.

I state that:

1. The price(s) and amount of this Bid have been arrived at independently and without consultation, communication or agreement with any other contractor, bidder or potential bidder.

2. Neither the price(s) nor the amount of this Bid, and neither the approximate price(s) nor approximate amount of this Bid, have been disclosed to any other firm or person who is a bidder or potential bidder, and they will not be disclosed before Bid opening.

3. No attempt has been made or will be made to induce any firm or person to refrain from bidding on this contract, or to submit a bid higher than this Bid, or to submit any intentionally high or noncompetitive bid or other form of complementary bid.

4. The Bid of my firm is made in good faith and not pursuant to any agreement or discussion with, or inducement from, any firm or person to submit a complementary or other noncompetitive bid.

5. Neither I nor anyone on behalf of this firm have agreed with another firm or representative or agent of another firm to sell items or services at the same price, to submit identical bids, to rotate bids, to share profits with a contractor who does not submit the low bid, to submit prearranged bids, agreed upon higher or lower bids or other complementary bids, to set up territories to restrict competition or not to submit bid.

6. _____, its affiliates,
(Name of My Firm)

subsidiaries, officers, directors and employees are not currently under investigation by any governmental agency and have not in the last three years been convicted or found liable for any act prohibited by State or Federal Law in any jurisdiction, involving conspiracy or collusion with respect to bidding on any public contract except as follows:

I state that _____
(Name of My Firm)

understands and acknowledges that the above representations are material and important and will be relied on by Catasauqua Area School District in awarding the contract(s) for which this Bid is submitted. I understand and my firm understands that any misstatement in this Affidavit is and shall be treated as fraudulent concealment from Catasauqua Area School District of the true facts relating to the submission of bids for this contract.

_____
(Name) _____

_____
(Company Position) _____

SWORN TO AND SUBSCRIBED

BEFORE ME THIS _____DAY

OF _____, 20_____ _____

_____
Notary Public

_____
My Commission Expires: _____

INSTRUCTION FOR NON-COLLUSION AFFIDAVIT

1. This Non-Collusion Affidavit is material to any contract awarded pursuant to this Bid. According to Section 4507 of the Pennsylvania Commonwealth Procurement Code, 62 Pa.C.S. § 4507, governmental agencies may require Non-Collusion Affidavits to be submitted together with bids.

2. This Non-Collusion Affidavit must be executed by the member, officer or employee of the bidder who makes the final decision on prices and the amount quoted in the bid.

3. Bid rigging and other efforts to restrain competition, and the making of false sworn statements in connection with the submission of bids are unlawful and may be subject to criminal prosecution. The person who signs the Affidavit should examine it carefully before signing and assure himself or herself that each statement is true and accurate, making diligent inquiry, as necessary, of all of persons employed by or associated with the bidder with responsibilities for the preparation, approval or submission of the bid.

4. In case of a bid submitted by a joint venture, each party to the venture must be identified in the Bid Documents, and an Affidavit must be submitted separately on behalf of each party.

5. The term “Complementary Bid” as used in the Affidavit has the meaning commonly associated with that term in the bidding process and includes the knowing submission of bids higher than the bid of another firm, any intentionally high or noncompetitive bid, and any other form of bid submitted for the purpose of giving a false appearance of competition.

6. Failure to file an Affidavit in compliance with these instructions may result in disqualification of the bid.

7. A bidder’s statement that it has been convicted or found liable for any act prohibited by Federal or State Law in any jurisdiction involving conspiracy or collusion with respect to bidding on any public contract within the last three (3) years does not prohibit a government agency from accepting a bid from or awarding a contract to that bidder, but it may be grounds for administrative suspension or debarment in the discretion of the government agency under the rules and regulations of that agency or, in the case of a government agency with no administrative suspension or debarment regulations or procedures, may be grounds for consideration on the question of whether the agency should decline to award a contract to that person on the basis of lack of responsibility.

END OF SECTION 004519

SECTION 005216 – AGREEMENT FORM

The "Standard Form of Agreement between Owner and Contractor, AIA Document A101, 2007 Edition, modified by the Owner for this project, shall be in effect for the duration of this project. A draft copy of the modified Agreement Form is bound herein.

END OF SECTION 005216

DRAFT

AIA® Document A101® – 2017

Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum

AGREEMENT made as of the « » day of « » in the year « »
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

«Borough of Conshohocken »« »
«400 Fayette Street »
«Conshohocken, PA 19428 »
« »

and the Contractor:
(Name, legal status, address and other information)

« »
« »
« »
« »

for the following Project:
(Name, location and detailed description)

Borough of Conshohocken Public Safety Facility »« »
«1111 Fayette Street »
« Conshohocken, PA 19428 »
« »
« »

The Architect:
(Name, legal status, address and other information)

«Alloy 5 Architeture »« »
«530 West Broad Street »
«Bethlehem, PA 18018 »
« »

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

The parties should complete A101®–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201®–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.



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TABLE OF ARTICLES

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EXHIBIT A INSURANCE AND BONDS

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:
(Check one of the following boxes.)

[« »] The date of this Agreement.

[«X»] A date set forth in a notice to proceed issued by the Owner.

[« »] Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

« »

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:
(Check one of the following boxes and complete the necessary information.)

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[« »] Not later than « » (« ») calendar days from the date of commencement of the Work.

[«X»] By the following date: «June 05, 2028» »

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be « » ($ « »), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item	Price

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance

§ 4.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item	Price

§ 4.4 Unit prices, if any:
(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit ($0.00)

§ 4.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any.)

« »

§ 4.6 Other:
(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)

« »

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ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

« »

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the «twenty-fifth- » day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the «last- » day of the «following » month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than «sixty- » (« 60 ») days after the Architect receives the Application for Payment.
(Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

.1 That portion of the Contract Sum properly allocable to completed Work;

.2 That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and

.3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

.1 The aggregate of any amounts previously paid by the Owner;

.2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;

.3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;

.4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and

.5 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:
(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

«As indicated in the Specification section 00.7300 – Supplementary Conditions »

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§ 5.1.7.1.1 The following items are not subject to retainage:
(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

« »

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

« As indicated in the Specification section 00.7300 – Supplementary Conditions »

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:
(Insert any other conditions for release of retainage upon Substantial Completion.)

« As indicated in the Specification section 00.7300 – Supplementary Conditions »

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and

.2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

« »

§ 5.3 Interest

Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
(Insert rate of interest agreed upon, if any.)

As provided at paragraph 13.5 of section 07300 Supplementary Conditions.
« » % « »

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.
(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

« »
« »

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« »
« »

§ 6.2 Binding Dispute Resolution
For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

[« »] Arbitration pursuant to Section 15.4 of AIA Document A201–2017

[«X»] Litigation in a court of competent jurisdiction

[« »] Other *(Specify)*

« »

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

ARTICLE 7 TERMINATION OR SUSPENSION
§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

§ 7.1.1 If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:
(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)

«As described in Article 14 of the AIA Document A201-2017, General Conditions of the Construction and modified by the specification section 00.7300 Supplementary Conditions »

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

ARTICLE 8 MISCELLANEOUS PROVISIONS
§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:
(Name, address, email address, and other information)

« »
« »
« »
« »
« »
« »

§ 8.3 The Contractor's representative:
(Name, address, email address, and other information)

« »
« »
« »
« »
« »

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« »

§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™–2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with a building information modeling exhibit, if completed, or as otherwise set forth below:
(If other than in accordance with a building information modeling exhibit, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

« »

§ 8.7 Other provisions:

« As indicated in the Specification section 00.7300 – Supplementary Conditions »

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor

.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds

.3 AIA Document A201™–2017, General Conditions of the Contract for Construction

.4 Building information modeling exhibit, dated as indicated below:
(Insert the date of the building information modeling exhibit incorporated into this Agreement.)

« »

.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

.8 Other Exhibits:
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

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[« »] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017 incorporated into this Agreement.)

« »

[« »] The Sustainability Plan:

Title	Date	Pages

[« »] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

« »

This Agreement entered into as of the day and year first written above.

OWNER *(Signature)*	**CONTRACTOR** *(Signature)*
« »« »	« »« »
(Printed name and title)	*(Printed name and title)*

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CONTRACTORS RESPONSIBILITY REQUIREMENTS

All contractors shall comply with the Contractor Responsibility Requirements of the Borough of Conshohocken Code of Ordinances, Chapter 13, Article B.
A copy of the applicable ordinance is included herein. Refer to the Instructions to Bidders for certification and submission requirements. Copies of the applicable ordinance and Contractor Responsibility Certification Form are included herein. Refer to the Instructions to Bidders for certification and submission requirements.

ARTICLE B.
Responsible Contractors.

§ 13-127. Subcontractor Responsibility Review Requirements. [Ord. 2014-02, 8/6/2014]

1. A construction manager, general contractor or other lead or prime contractor shall not be permitted to use a subcontractor on any work performed for the Borough unless it has identified the subcontractor on its subcontractor list and provided a subcontractor responsibility certification in accordance with the requirements of § 13-125.

2. A subcontractor listed on a firm's subcontractor list shall not be substituted unless written authorization is obtained from Borough and a subcontractor responsibility certification is provided for the substitute subcontractor.

3. In the event that the Borough determines that a prospective subcontractor listed by the apparent low bidder does not meet the responsibility standards of this section, it may, after informing the prospective awardee, exercise one of the following options:

   A. Permit the awardee to substitute a qualified, responsible, subcontractor in accordance with the requirements of this section;

   B. Require the awardee to self-perform the work in question if the firm has the required experience, licenses and other qualifications to perform the work in question; or

   C. Disqualify the prospective awardee.

4. In the event that a subcontractor is disqualified under this Part, the general contractor, construction manager or other lead or prime contractor shall not be permitted to make any type of contractual claim against the Borough on the basis of a subcontractor disqualification.

§ 13-121. Purpose. [Ord. 3-2006, 4/19/2006]

1. The Borough of Conshohocken ("hereinafter Conshohocken") recognizes that there is a need to ensure that all work on public construction and maintenance contracts is performed by responsible, qualified firms that maintain the capacity, expertise, personnel, and other qualifications and resources necessary to successfully perform such contracts in a timely, reliable and cost-effective manner.

2. Therefore, Conshohocken shall require compliance with the provisions of this Part by business entities seeking to provide services to Conshohocken as specified herein. The requirements of this Part are intended to supplement, not replace, existing contractor qualification and performance standards or criteria currently required by law, public policy or contracting documents. However; in the event that any of the provisions of this conflict with any law of Conshohocken, this Part shall prevail.

§ 13-122. Responsible Contractor Requirements. [Ord. 2014-02, 8/6/2014[1]]

1. All contractors and subcontractors of any tier that perform work valued at over $350,000 on any public facility or public works project, including construction, demolition, alteration, renovation, repair and contract service or contract maintenance work, shall meet the requirements of this Part.

2. All firms engaged in contracts covered by this Part shall be qualified, responsible contractors or subcontractors that have sufficient capabilities in all respects to successfully perform contracts on which they are engaged, including the necessary experience, equipment, technical skills and qualifications and organizational, financial and personnel resources. Firms bidding on public contracts shall also be required to have a satisfactory past performance record and a satisfactory record of law compliance, integrity and business ethics.

§ 13-123. Contractor Responsibility Certifications. [Ord. 2014-02, 8/6/2014]

1. As a condition of performing work on a public works contract subject to this Part, a general contractor, construction manager or other lead or prime contractor seeking award of a contract

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1. Editor's Note: This Part repealed former §§ 13-122 through 13-128, which were adopted by Ord. 3-2006, 4/19/2006.

shall submit a contractor responsibility certification at the time it submits its bid for a contract.

2. The contractor responsibility certification shall be completed on a form provided by the Borough and shall reference the project for which a bid is being submitted by name and contract or project number.

3. In the contractor responsibility certification, the construction manager, general contractor or other lead or prime contractor shall confirm the following facts regarding its past performance and work history and its current qualifications and performance capabilities:

   A. The firm and its employees have all valid, effective licenses, registrations or certificates required by federal, state, county, or local law, including, but not limited to, licenses, registrations or certificates required to: a) do business in the designated locale; and b) perform the contract work it seeks to perform. These shall include, but not be limited to, licenses, registrations or certificates for any type of construction or maintenance trade work or specialty work which the firm proposes to self-perform.

   B. The firm meets the bonding requirements for the contract, as required by applicable law or contract specifications and any insurance requirements, as required by, applicable law or contract specifications, including general liability insurance, workers' compensation insurance and unemployment insurance.

   C. The firm has not been debarred or suspended by any federal, state or local government agency or authority in the past three years.

   D. The firm has not defaulted on any project in the past three years.

   E. The firm has not had any type of business, contracting or trade license, registration, or other certification revoked or suspended in the past three years.

   F. The firm and its owners have not been convicted of any crime relating to the contracting business in the past 10 years.

   G. The firm has not within the past three years been found in violation of any law applicable to its contracting business, including, but not limited to, licensing laws, tax laws, prompt

payment laws, wage and hour laws, prevailing wage laws, environmental laws or others, where the result of such violation was the payment of a fine, backpay damages or any other type of penalty in the amount of $1,000 or more.

H. The firm will pay all craft employees that it employs on the project the current wage rates and fringe benefits as required under applicable federal, state or local wage laws.

I. All craft labor that will be employed by the firm for the project have completed at least the OSHA ten-hour training course for safety established by the U.S. Department of Labor, Occupational Safety and Health Administration.

J. The firm will employ craft employees in all classifications and individual trades required to successfully perform the work related to this project.

K. The firm has participated in a Class A apprenticeship program for the past three years, at a minimum, for each separate trade or classification in which it employs craft employees and shall continue to participate in such program or programs for the duration of the project.

(1) For purposes of this section, a Class A apprenticeship program is an apprenticeship program that is currently registered with and approved by the U.S. Department of Labor or a state apprenticeship agency and has graduated apprentices to journeyperson status for at least three of the past five years.

(2) To demonstrate compliance with this section, the firm shall provide, with this certification, a list of all trades or classifications of craft employees it will employ on the project and documentation verifying it participates in a Class A apprenticeship program for each trade or classification listed.

L. The firm has all other technical qualifications and resources, including equipment, personnel and financial resources, to perform the referenced contract, or will obtain same through the use of qualified, responsible subcontractors.

M. The firm will maintain all qualifications, resources and capabilities referenced in this certification throughout the duration of the project.

N. The firm shall notify the Borough within seven days of any material changes to all matters attested to in this certification.

O. The firm understands that the contractor responsibility certification required by this section shall be executed by a person who has sufficient knowledge to address all matters in the certification and shall include an attestation stating, under the penalty of perjury, that the information submitted is true, complete and accurate.

4. Execution of the contractor responsibility certification required by this Part shall not establish a presumption of contractor responsibility, and the Borough may require any additional information it deems necessary to evaluate a firm's status as a responsible contractor, including technical qualifications, financial capacity or other resources and performance capabilities. The Borough may require that such information be included in a separate statement of qualifications and experience or as an attachment to the contractor responsibility certification.

5. The submitting firm shall stipulate in the contractor responsibility certification that if it receives a notice of intent to award contract, it will provide a subcontractor list and required subcontractor information as specified in § 13-125 of this Part.

6. If the submitting firm has ever operated under another name or controls, is controlled by another company or business entity or in the past five years controlled or was controlled by another company or business entity, whether as a parent company, subsidiary or in any other business relation, it shall attach a separate statement to its contractor responsibility certification that explains in detail the nature of any such relationship. Additional information may be required from such an entity if the relationship in question could potentially impact contract performance.

7. If a firm fails to provide a contractor responsibility certification required by this section, it shall be disqualified from bidding. No action of any nature shall lie against the Borough because of its refusal to accept a bid for failing to provide information required by this section.

§ 13-124. Notice of Intent to Award Contract. [Ord. 2014-02, 8/6/2014]

1. After it has received bids for a project, the Borough shall issue a notice of intent to award contract to the firm offering the lowest responsive bid.

2. Such notice shall be issued immediately or as soon as practicable after bids are submitted and shall stipulate that the contract award will be conditioned on the issuance of a written contractor responsibility determination, as required by § 13-126 and any other conditions determined appropriate by the Borough.

§ 13-125. Subcontractor Lists; Subcontractor Responsibility Certifications. [Ord. 2014-02, 8/6/2014]

1. Within seven days from the date of notice of intent to award contract, a prospective awardee shall submit to the Borough a subcontractor list containing the names of subcontractors that will be used for the referenced project, their addresses and a description of the work each listed subcontractor will perform on the project.

2. At the time a prospective awardee submits the subcontractor list, it shall also submit subcontractor responsibility certifications for all listed subcontractors to the Borough. Subcontractor responsibility certifications shall be executed by the respective subcontractors on forms prepared by the Borough and shall contain the same information and representations required in contractor responsibility certifications, including verification of apprenticeship qualifications as required by § 13-123, Subsection 3K, for each trade or classification of craft workers it will employ on the project.

3. Subcontractor responsibility certifications shall be executed by persons having sufficient knowledge to address all matters in the certification and shall include an attestation stating, under the penalty of perjury, that all information submitted is true, complete and accurate.

§ 13-126. Contractor Responsibility Review and Determination. [Ord. 2014-02, 8/6/2014]

1. After a notice of intent to award contract has been issued, the Borough shall undertake a review process to determine whether the prospective awardee is a qualified, responsible contractor in accordance with the requirements of this Part and other applicable laws and regulations and has the resources and capabilities to successfully perform the contract. The time of the

review process shall be as determined necessary by the Borough, but in no event less than five calendar days.

2. As part of this review process, the Borough shall ensure that the contractor responsibility certification, the subcontractor list and the subcontractor responsibility certifications, as required by this Part, have been submitted and properly executed.

3. The Borough may conduct any additional inquiries to verify that the prospective awardee and its subcontractors have the technical qualifications and performance capabilities necessary to successfully perform the contract and that the firms have a sufficient record of law compliance and business integrity to justify the award of a public contract. In conducting such inquiries, the Borough may seek relevant information from the firm, its prior clients or customers, its subcontractors or any other relevant source.

4. If at the conclusion of the review process the Borough determines that all responsibility certifications have been properly completed and executed, and if it concludes that the qualifications, background and responsibility of the prospective awardee and the firms on its subcontractor list are satisfactory, it may issue a written contractor responsibility determination verifying that the prospective awardee is a qualified, responsible contractor. In the event a firm is determined to be nonresponsible, the Borough shall proceed to conduct a responsibility review of the next lowest responsive bidder or, if necessary, rebid the project.

5. A contractor responsibility determination may be issued after the conclusion of the review process under § 13-126, Subsection 1. A responsibility determination may be revoked or revised in any manner at any time if the Borough obtains relevant information warranting any such revocation or revisions.

§ 13-128. False or Misleading Responsibility Certifications. [Ord. 2014-02, 8/6/2014]

If the Borough determines that a contractor or subcontractor responsibility certification contains false or misleading material information that was provided knowingly or with reckless disregard for the truth or omits material information knowingly or with reckless disregard of the truth, the firm for which the certification was submitted shall be prohibited from performing work for the Borough for a period of three years and shall be subject to any other penalties and sanctions, including contract termination, available to the

Borough under law. A contract terminated under these circumstances shall further entitle the Borough to withhold payment of any monies due to the firm as damages.

§ 13-129. Award of Final Contract. [Ord. 2014-02, 8/6/2014]

1. A contract subject to this Part shall not be executed until all requirements of this Part have been fulfilled and until contractor and subcontractor responsibility certifications have been issued by the Borough under § 13-126, Subsection 4.

2. Prior to the execution of a final contract under this section, the Borough shall publicly post the notice of intent to award contract, contractor and subcontractor responsibility certifications, and subcontractor lists on the Borough website for public inspection for a period not less than five calendar days after the issuance of the responsibility certifications.

§ 13-130. Public Review Process. [Ord. 3-2006, 4/19/2006]

1. To permit adequate public review of the procurement process, Conshohocken shall provide a ten-day public review period commencing from the date the Notice of Intent to Award Contract is issued.

2. During this period, the Contractor Responsibility Certification, subcontractor list, Subcontractor Responsibility Certifications and the Determination of Contractor Responsibility, as specified herein, shall be subject to immediate public inspection as they become available.

3. These records shall be made available for public inspection in a public document room or on a publicly accessible web site. In the alternative, copies of these records shall be produced or otherwise made available for public inspection within five business days upon written request.

4. During the public review period, any person or organization may protest a contractor or subcontractor for failing to meet applicable requirements of this Part or for any other legitimate ground by submitting a letter with supporting evidence to Conshohocken.

5. A procurement contract subject to this Part shall not be executed until all requirements of this Part have been fulfilled.

BOROUGH OF CONSHOHOCKEN

CONTRACTOR/SUBCONTRACTOR RESPONSIBILITY CERTIFICATION

RESPONSIBLE CONTRACTOR REQUIREMENTS
CHAPTER 13, SECTIONS 121-130

ALL CONTRACTORS AND SUBCONTRACTORS OF ANY TIER THAT PERFORM WORK ON A CONTRACT VALUED AT OVER $350,000 ON ANY PUBLIC FACILITY OR PUBLIC WORKS PROJECT, INCLUDING CONSTRUCTION, DEMOLITION, ALTERATION, RENOVATION, REPAIR AND CONTRACT SERVICE OR CONTRACT MAINTENANCE WORK, SHALL MEET THE REQUIREMENT OF THE BOROUGH OF CONSHOHOCKEN RESPONSIBLE CONTRACTORS REQUIREMENTS, CHAPTER 13 SECTIONS 121-130.

IF A FIRM FAILS TO PROVIDE THIS CONTRACTOR RESPONSIBILITY CERTIFICATION, IT SHALL BE DISQUALIFIED FROM BIDDING. NO ACTION OF ANY NATURE SHALL LIE AGAINST THE BOROUGH BECAUSE OF ITS REFUSAL TO ACCEPT A BID FOR FAILING TO PROVIDE THE REQUIRED INFORMATION. IN THE EVENT THAT A SUBCONTRACTOR IS DISQUALIFIED, NO TYPE OF CONTRACTUAL CLAIM SHALL BE PERMITTED AGAINST THE BOROUGH ON THE BASIS ON A SUBCONTRACTOR DISQUALIFICATION.

CONTRACTORS: As a condition of performing work on a public works contract subject to this ordinance, a general contractor, construction manager, or other lead or prime contractor seeking award of a contract shall submit this Contractor Responsibility Certification at the time it submits its bid for a contract.

SUBCONTRACTORS: The Subcontractor Responsibility Certification shall be executed by the respective subcontractors of any tier upon request by the Contractor on this form and shall contain the same information and representations required in the Contractor Responsibility Certifications, including verification of apprenticeship qualifications as required by Chapter 13 Section 123.3.K, for each trade or classification of craft workers it will employ on the project.

Name of Company: _____

Address: _____

_____

_____

Phone No.: _____ Email: _____

Contract Name/Number: _____

Role in project: _____

_____

The construction manager, general contractor, other lead or prime contractor, or subcontractor shall confirm the following facts regarding its past performance and work history and its current qualification and performance capabilities:

1. Does the firm and its employees have all valid, effective licenses, registrations and/or certificates required by federal, state, county, or local law, including, but not limited to, licenses, registrations or certificates required to (a) do business in the designated locale; (b) perform the contract work it seeks to perform? This shall include, but is not limited to, licenses, registrations or certificates for any type of construction or maintenance trade work or specialty work which the firm proposed to self-perform.

   YES _____ NO _____

   If no, please explain: _____

   _____

   _____

2. Does the firm meet the bonding requirements for the contract, as required by applicable law or contract specifications and any insurance requirements, as required by applicable law or contract specifications, including general liability insurances, workers' compensation insurance and unemployment insurance?

   YES _____ NO _____

   If no, please explain: _____

   _____

   _____

3. Has the firm been debarred or suspended by any federal, state or local government agency or authority in the past three (3) years?

   YES _____ NO _____

   If yes, please explain: _____

   _____

   _____

4. Has the firm defaulted on any project in the past three (3) years?

   YES _____ NO _____

   If yes, please explain: _____

   _____

   _____

5. In the past three (3) years, has the firm had any type of business, contracting or trade license, registration, or other certification revoked or suspended?

   YES _____ NO _____

   If yes, please explain: _____

   _____

   _____

6. In the past 10 years, has the firm and its owners been convicted of any crime relating to the contracting business?

YES _____ NO _____

If yes, please explain: _____

_____

_____

7. In the past three (3) years, has the firm been found in violation of any law applicable to its contracting business, including, but not limited to, licensing laws, tax laws, prompt payment laws, wage and hour laws, prevailing wage laws, environmental laws or others, where the result of such violation was the payment of a fine, backpay damages or any other type of penalty in the amount of $1,000.00 or more?

YES _____ NO _____

If yes, please explain: _____

_____

_____

8. Does the firm agree to pay all craft employees that it employs on the project the current wage rates and fringe benefits as required under applicable federal, state or local wage laws?

YES _____ NO _____

If no, please explain: _____

_____

_____

9. Does the firm agree that all craft labor that will be employed by the firm for the project have competed at least the OSHA 10-hour training course for safety established by the U.S. Department of Labor, Occupational Safety and Health Administration?

YES _____ NO _____

If no, please explain: _____

_____

_____

10. Does the firm agree to employ craft employees in all classifications and individual trades required to successfully perform the work related to this project?

YES _____ NO _____

If no, please explain: _____

_____

_____

11. Has the firm participated in a Class A Apprenticeship Program for at least the past three (3) years, at a minimum, for each separate trade or classification in which it employs craft employees?

For purposes of this Certification, a Class A Apprenticeship Program is defined as an apprenticeship program that is currently registered with and approved by the U.S. Department of Labor or a state apprenticeship agency and has graduated apprentices to journeyperson status for at least three (3) of the past five (5) years.

YES _____ NO _____

If no, please explain: _____

_____

_____

12. Has the firm attached to this Certification a list of all trades or classifications of craft employees it will employ on the project and documentation that it participates in a Class A Apprenticeship Program for each trade or classification listed?

YES _____ NO _____

If no, please explain: _____

_____

_____

13. Has the firm attached documentation to this Certification to confirm that there have been apprentices graduated to journeyperson status for at least three (3) of the past five (5) years from each Class A Apprenticeship Program it participates in for each separate trade or classification in which it employs craft employees?

YES _____ NO _____

If no, please explain: _____

_____

_____

14. Does the firm have all other technical qualifications and resources, including equipment, personnel and financial resources, to perform the referenced contract, or will obtain same through the use of qualified, responsible subcontractors?

YES _____ NO _____

If no, please explain: _____

_____

_____

15. Does the firm agree to maintain all qualifications, resources and capabilities referenced in this Certification throughout the duration of the project?

YES _____ NO _____

If no, please explain: _____

_____

_____

16. Does the firm agree to notify the Borough of Conshohocken within seven (7) days of any material changes to all matters attested to in this Certification?

YES _____ NO _____

If no, please explain: _____

_____

_____

17. Does the firm attest that execution of this Certification does not establish a presumption of contractor responsibility and that the Borough of Conshohocken may require any additional information it deems necessary to evaluate a firm's status as a responsible contractor, including technical qualifications, financial capacity or other resources and performance capabilities, which may be a separate statement of qualifications and experience or an attachment to the Contractor Responsibility Certification?

YES _____ NO _____

If no, please explain: _____

_____

_____

18. Does the firm attest that if it has ever operated under another name or controls, is controlled by another company or business entity or in the past five (5) years controlled or was controlled by another company or business entity, whether as a parent company, subsidiary or in any other business relation, it has attached a separate statement to this Certification that explains in detail the nature of any such relationship, including any additional information that may be required from such an entity if the relationship in question could potentially impact contract performance?

YES _____ NO _____

If no, please explain: _____

_____

_____

19. Does the construction manager, general contractor or other lead or prime contractor firm attest that it shall provide a subcontractor list, subcontractor information, and Subcontractor Responsibility Certifications for all listed subcontractors within seven (7) days as specified in Chapter 13 Section 125 if the firm receives a Notice of Intent to Award the contract?

YES _____ NO _____

If no, please explain: _____

_____

I hereby certify that this Contractor/Subcontractor Responsibility Certification has been executed by persons having sufficient knowledge to address all matters in this Certification and that, under the penalty of perjury, certify that all information submitted is true, complete and accurate.

_____ Date: _____

Authorized Signature

PRINT:

_____

Name

_____

Title

_____ Date: _____

Witness Signature

END OF DOCUMENT

SECTION 00.7216 – GENERAL CONDITIONS

The “General Conditions of the Contract for Construction”, AIA Document A201-2017 has been modified by supplementary conditions for this project and shall be in effect for the duration of this project.

END OF SECTION 00.7216

DRAFT

AIA® Document A201® – 2017

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

« Borough of Conshohocken Public Safety Facility »« »
«1111 Fayette Street »
« Conshohocken, PA 19428 »
« »

THE OWNER:
(Name, legal status and address)

« Borough of Conshohocken »« »
«400 Fayette Street »
«Conshohocken, PA 19428 »« »
« »

THE ARCHITECT:
(Name, legal status and address)

« Alloy 5 Architeture »« »
«530 West Broad Street »
«Bethlehem, PA 18018 »
»« »
« »

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ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

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User Notes: (1178101065)

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

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§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon written protocols governing the transmission and use of, and reliance on, Instruments of Service or any other information or documentation in digital form.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to written protocols governing the use of, and reliance on, the information contained in the model shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

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ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

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§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These

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obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

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§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

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§ 3.8.2 Unless otherwise provided in the Contract Documents,

- **.1** allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- **.2** Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- **.3** whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

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§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and

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other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to

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injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed.

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However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

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§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- **.1** assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
- **.2** assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

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§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

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§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

- **.1** The change in the Work;
- **.2** The amount of the adjustment, if any, in the Contract Sum; and
- **.3** The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- **.1** Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- **.2** Unit prices stated in the Contract Documents or subsequently agreed upon;
- **.3** Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- **.4** As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

- **.1** Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
- **.2** Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;

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.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and

.5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

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§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

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§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- **.1** defective Work not remedied;
- **.2** third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- **.3** failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
- **.4** reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;

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.5 damage to the Owner or a Separate Contractor;
.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
.7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

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§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

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§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- **.1** liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- **.2** failure of the Work to comply with the requirements of the Contract Documents;
- **.3** terms of special warranties required by the Contract Documents; or
- **.4** audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- **.1** employees on the Work and other persons who may be affected thereby;

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.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and

.3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities

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proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the

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procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

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The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

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§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public

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authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- **.1** Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- **.2** An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- **.3** Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- **.4** The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

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§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- **.1** repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- **.2** fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- **.3** repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- **.4** otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- **.1** Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- **.2** Accept assignment of subcontracts pursuant to Section 5.4; and
- **.3** Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- **.1** that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- **.2** that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- **.1** cease operations as directed by the Owner in the notice;
- **.2** take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- **.3** except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

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§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

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§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

.1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

.2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

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§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

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§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

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SECTION 00.7300 - SUPPLEMENTARY CONDITIONS

GENERAL

The following supplements modify the "General Conditions of the Contract for Construction", AIA Document A201 – 2017. Where a portion of the General Conditions is modified or deleted by these Supplementary Conditions, the unaltered portions of the General Conditions shall remain in effect.

These supplementary conditions to the contract have been authored by several design professionals and the Borough solicitor. They are interpreted by ALLOY5 ARCHITECTURE as the property of the BOROUGH OF CONSHOHOCKEN. Any discrepancies in these conditions shall be brought to the attention of the Architect prior to placing bid.

ARTICLE 1, GENERAL PROVISIONS

Paragraph 1.1 **BASIC DEFINITIONS**. To subparagraph 1.1.1, delete the last sentence and replace with the following:

"The Contract Documents **DO** include the bidding requirements, which include the Invitation to Bid, the Instructions to Bidders, the Bid Form, Bonds, Bid Security, Prevailing Wage Pre-Determination and portions of addenda relating to Invitation to Bid, the Instructions to Bidders, the Bid Form, Bonds, Bid Security, Prevailing Wage Pre-Determination."

Paragraph 1.1 **BASIC DEFINITIONS**. Paragraph 1.1.3 THE WORK, add new subparagraphs 1.1.3.1 and 1.1.3.2 as follows:

1.1.3.1 Contractor must visit the site of the project before submitting a proposal. Such site visit shall be for the purpose of familiarizing the Contractor with the existing conditions and assessment of the contractors' ability to perform the Work, schedule the Work, execute the Work and Warrant the Work.

1.1.3.2 Contractor shall not interpret Contract Documents in a manner imposing to Owner or Architect, or their agents, employees, officers, directors, or consultants, any duty, obligation, or authority with respect to any items that are not intended to be incorporated into the completed project, or that do not comprise the Work, including, but not limited to, the following: shoring, scaffolding, hoists, weatherproofing, or any temporary facility or activity, because these are the sole responsibility of the Contractor

Paragraph 1.1 **BASIC DEFINITIONS**. To paragraph 1.1.5, THE DRAWINGS, add the following subparagraphs:

1.1.5.1 The Drawings are diagrammatic. Exact slopes, pitches, locations of equipment and points of termination shall be verified by Contractor and approved by owner. This shall include both new work and existing conditions. Should it be found that any system or equipment cannot be installed as shown on the Drawings, the Architect shall be notified in writing before installing or making changes to layout.

1.1.5.2 Contractor shall carefully examine the Contract Drawings and Specifications. If any discrepancies occur between the Drawings or between the Drawings and Specifications, the Contractor

shall report such discrepancies to the Architect in writing and obtain written instructions as to the manner in which to proceed. No departures from the Contract Documents shall be made without prior written approval of the Architect.

Paragraph 1.1 **BASIC DEFINITIONS**. Add new subparagraph 1.1.9, THE OWNER as follows:

1.1.9 The term "Owner" as used in the Contract Documents refers to the BOROUGH OF CONSHOHOCKEN

Paragraph 1.1 **BASIC DEFINITIONS**. Add new subparagraph 1.1.10, THE ARCHITECT as follows:

1.1.10 The term "Architect" as used in the Contract Documents refers to **ALLOY5 ARCHITECTURE**.

Paragraph 1.1 **BASIC DEFINITIONS**. Add new subparagraph 1.1.11, COMPLETION DATE as follows:

1.1.11 The term completion date means any substantial completion, final completion, milestone, phase as identified in the contract documents.

Paragraph 1.1 **BASIC DEFINITIONS**. Add new subparagraph 1.1.12, THE CONTRACTORS as follows:

1.1.12 The terms, "Prime Contractor", "General Contractor", "Lead Contractor" and or "Contractor" as used in the Contract Documents are defined as the Contractor performing Work.

Paragraph 1.2 **CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS**. To paragraph 1.2.1 add the following subparagraph 1.2.1.2:

1.2.1.2 The Drawings and Specifications are a collective set of documents. Anything shown on the Drawings, but not in the Specifications, or mentioned in the Specifications and not shown on the Drawings, shall be equally binding as if both noted on the Drawings and called for in the Specifications. Architect shall make the final decision consistent with the general intent of the Contract Documents.

Paragraph 1.2 **CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS**. To paragraph 1.2.2 add the following:

The Contractor shall verify dimensions and existing conditions prior to submitted bid and continually while performing work. It is understood, warranted and guaranteed by contractor that this work has been performed and will continue to be performed from the date of receipt of the invitation to bid to final completion.

Paragraph 1.2 **CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS**. To subparagraph 1.2.3 add the following: In the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the Architect's Interpretations of the Contract Documents.

In the case of an inconsistency within or between Contract Documents not clarified by Addendum, the better quality or greater quantity of work shall be provided in accordance with Architect's interpretation.

Paragraph 1.2 **CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS**. Add the following new subparagraphs 1.2.4, 1.2.5, 1.2.6, 1.2.7, 1.2.8, 1.2.9 and 1.2.10:

1.2.4 Do not scale drawings. Working measurements shall be taken from figured dimensions. Computed dimensions shall take precedence over scale dimensions, and large scale drawings shall take precedence over small scale drawings

1.2.5 Contractor shall carefully examine the Contract Drawings and Specifications. If any discrepancies occur between the Drawings or between the Drawings and Specifications, the Contractor shall report such discrepancies to the Architect in writing and obtain written instructions as to the manner in which to proceed. No departures from the Contract Documents shall be made without prior written approval of the Architect.

1.2.6 Where the work is shown in complete detail on only half or portion of a Drawing or there is an indication of continuation, the remainder being shown in outline, the work drawn out in detail shall be understood to apply to other like portions of the structure. On all work of a remodeling nature or installation within the present buildings, it will be the responsibility of the Contractor, by personal inspection, to satisfy himself as to the correctness of any information given which may affect the quantity of materials required for a satisfactorily completed contract, whether or not such information is indicated on the Drawings or within the Specifications.

1.2.7 The Drawings are generally diagrammatic and indicative of the work to be installed. Exact locations of equipment and points of termination shall be approved by the Architect. Should it be found that any system or equipment cannot be installed as shown on the Drawings, the Architect shall be notified in writing before installing or making changes to layout.

1.2.8 Anything shown on the Drawings and not mentioned in the Specifications or mentioned in the Specifications and not shown on the Drawings shall have the same effect as if shown or mentioned respectively in both. Any work shown on one Drawing shall be construed to be shown on all Drawings, and the Contractor shall coordinate the Work and Drawings to conform to the requirements of the Contract Documents. Clarifications will be made for questions and discrepancies called to the Architects attention, in writing, within the time period established for questions. Clarifications prior to the bid will be issued as Addenda to the Contract Documents. If such correction or clarification is not made, the work in question shall be considered to be required as specified and shown on the drawings.

1.2.9 The General and Supplementary General Conditions, Specifications, and Drawings contemplate a finished piece of work of such character and quality as is described in and is reasonably inferable from them and the Contractor, recognizing the impossibility of producing drawings and specifications with perfect accuracy, agrees that his submitted price for the work hereinunder includes sufficient money allowance to make his work complete and operable, fitting with the work of other contractors and the Owner and in compliance with good practice and the ordinances, codes, and regulations of all bodies or persons having governmental authority over it. The Contractor agrees that inadvertent discrepancies or the failure to repeat on any drawing the figures or notes given on another shall not be the cause for additional charges or claims.

1.2.10 If tight conditions develop, the Contractor shall make arrangements to jointly prepare composite drawings, showing the suggested solution and submit it to the Architect for comment, and if necessary, approval. All contractors are deemed to have taken into consideration that interferences will occur at

various points and it shall be understood that extras for necessary variation will not be approved. All Contractors shall verify all measurements at the site.

Paragraph 1.5 **OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE**, add the following new subparagraph 1.5.3:

1.5.3 Contractor's Use of Instruments of Service in Electronic Form:

1.5.3.1 The Architect may, with the concurrence of the Owner, furnish to the Contractor versions of Instruments of Service in electronic form. The Contract Documents executed or identified in accordance with Subparagraph 1.5.1 shall prevail in case of an inconsistency with subsequent versions made through manipulatable electronic operations involving computers.

1.5.3.2 The Contractor shall not transfer or reuse Instruments of Service in electronic or machine readable form without the prior written consent of the Architect.

Paragraph 1.6 NOTICE, In subparagraph 1.6.1, add the following:

"Notice by mail shall be effective three (3) days after deposit in the mail."

Add the following paragraph 1.9 to **Article 1**:

1.9 Meetings

Representatives of the Owner, Contractor and Architect shall meet periodically at mutually agreed-upon intervals for the purpose of establishing procedures to facilitate cooperation, communication and timely responses among the participants. By participating in this arrangement, the parties do not intend to create additional contractual obligations or modify the legal relationships which may otherwise exist.

ARTICLE 2, OWNER

Paragraph 2.1 **GENERAL**, delete paragraph 2.1.2 in its entirety.

Paragraph 2.3 **INFORMATION AND SERVICES REQUIRED OF THE OWNER**, delete paragraph 2.3.1 and replace with the following.

The Owner will secure and pay for necessary zoning approvals, site development approvals, highway access approvals, design approvals, and other approvals related to permanent facilities and required precedent to applications for permits for work at the site.

Paragraph 2.3 **INFORMATION AND SERVICES REQUIRED OF THE OWNER**, delete Subparagraph 2.3.4 and replace with the following:

2.3.4 The Owner has furnished surveys to the Architect describing the physical characteristics, legal limitations, and utility locations for the site of the Project. This information was furnished only for the Architect's use in design and is not a part of the Contract Documents. The information is available for the

Contractors' information, but is not a warranty of physical conditions. The Contractor shall visit the site and become acquainted with the existing conditions. Prior to Bidding, the Contractors may make their own investigation to become satisfied as to the site and physical conditions, but such investigation may be performed only under time schedules and arrangements approved in advance by the Owner.

Paragraph 2.3 **INFORMATION AND SERVICES REQUIRED OF THE OWNER**, delete Subparagraph 2.3.6 and substitute the following:

2.3.6 The Contractor will be furnished, free of charge, an electronic copy of the contract documents. Hard copies will not be provided.

Paragraph 2.3 INFORMATION **AND SERVICES REQUIRED OF THE OWNER**, add new Subparagraph 2.3.7 as follows:

2.3.7 Contractors are to perform all factory or shop testing and any other field testing of above or below ground pipes, including pressure, air or vacuum testing required.

Paragraph 2.5 OWNER'**S RIGHT TO CARRY OUT THE WORK**, delete the text of Paragraph 2.5 and replace with the following subparagraphs 2.5.1 and 2.5.2:

2.5.1 The Owner shall not be required to comply with the notice provisions hereof, and may proceed to correct deficiencies if Contractor fails within a 24-hour period after receipt of written notice from the Owner to commence and continue correction of such deficiencies where further delay would cause disruption to the project schedule.

2.5.2 If the Contractor fails to commence and continue to correct any deficiencies, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies.

ARTICLE 3, CONTRACTOR

Paragraph 3.1 **GENERAL**. Add new subparagraphs 3.1.4 and 3.1.5 as follows:

3.1.4 Owner reserves the right in its sole and absolute discretion to refuse access to the site or reject from the site any person Owner deems unfit to be permitted on Borough property

3.1.5 Contractor is the sole entity responsible for coordination of Work. Coordination of work shall not be subcontracted to any other entity or assumed to be provided by the Owner or Architect.

Paragraph 3.2 **REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTO**R, Subparagraph 3.2.1, add the following:

Execution of the Contract by the Contractor is also a representation that the Contractor has carefully examined the Contract Documents, that the Contractor thoroughly understands the Contract Documents and their intent and purpose, and is familiar with all applicable codes, ordinances, laws, regulations and rules as they apply to the Work and that the Contractor will abide by same.

Paragraph 3.2 **REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR**. Add new subparagraph 3.2.1.1 as follows:

3.2.1.1 The Contractor shall review the drawings and Work of other separate prime contracts to determine if that Work affects the Contractor's planned Work and also to coordinate and schedule the required work.

Paragraph 3.2 **REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR**. In sub paragraph 3.2.4, delete the last sentence and replace with the following:

The Contractor shall be liable for errors, inconsistencies or omissions in the Contract Documents or from differences between field measurements or conditions and the Contract Documents.

Paragraph 3.2 **REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR**. Add subparagraphs 3.2.5, 3.2.6, 3.2.7, 3.2.8 and 3.2.9 as follows:

3.2.5 Where manufacturer's standard specifications and standard methods of fabrication, installation or erection are referenced in the Contract Documents, Contractor shall submit two copies of each to the Architect before start of work.

3.2.6 The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect for the Architect to evaluate and respond to the Contractor's requests for information, where such information was available to the Contractor from a careful study and comparison of the Contract Documents, field conditions, other Owner-provided information, Contractor-prepared coordination drawings, or prior Project correspondence or documentation.

3.2.7 Explorations and Reports: Reference is made to the General Requirements and Bidding Documents for identification of those reports of explorations and tests of subsurface conditions at the site that have been utilized by Architect in preparation of the Contract Documents. Contractor may rely upon the accuracy of the technical data contained in such reports, but not upon non-technical data, interpretations or opinions contained therein or for the completeness thereof for contractor's purposes. Except as indicated in the immediately preceding sentence and in paragraph 3.7.4, contractor shall have full responsibility with respect to subsurface conditions at the site.

3.2.8 Existing Structures: Reference is made to the Bidding Documents for identification of those drawings of physical conditions in or relating to existing surface structures which are at or contiguous to the site that have been utilized by Architect in preparation of the Contract Documents. Contractor may rely upon the accuracy of the technical data contained in such drawings, but not for the completeness thereof for contractors purposes. Except as indicated in the immediately preceding sentence and in paragraph 3.7.4, contractor shall have full responsibility with respect to physical conditions in or relating to such natures.

3.2.9 The Contractor shall give the Architect timely notice of any additional design drawings, specifications, or instructions required to define the Work in greater detail, or to permit the proper progress of the Work. The Contractor shall not proceed with any work not clearly and consistently defined in detail in the Contract Documents, special requests, additional drawings or instructions from

the Architect. If the Contractor proceeds with such work without obtaining further drawings or instruction, he shall correct work incorrectly done at his own expense.

Paragraph 3.3 **SUPERVISION AND CONSTRUCTION PROCEDURES**. Add subparagraphs 3.3.4 and 3.3.5 as follows:

3.3.4 Contractor's supervision of work shall include expediting and coordination of work of trades, supervising and procuring required to insure delivery of materials to maintain work schedules of sub-contractors and progress schedule of project to insure full completion of work, to supply equipment or instruments necessary to complete specified test, checks, balancing of system, to furnish operating instructions, etc.

3.3.5 The Contractor, his employees or his subcontractors shall not install any product or equipment in a manner which is in direct conflict with the manufacturer's recommended requirements. If the manufacturer of the product or equipment has requirements which can not be met by the specific application indicated, the Contractor shall bring this information to the attention of the Architect. Products or equipment installed contrary to their manufacturer's requirements shall be replaced at no additional cost to the Owner unless specifically authorized in writing by the Architect.

Paragraph 3.4 **LABOR AND MATERIALS**. Add subparagraphs 3.4.4, 3.4.5, and 3.4.7 as follows:

3.4.4 Contractor shall not place any order for materials which are not in accordance with the Contract Documents, unless he has informed both the Architect and the Owner of such additional changes and charges and has received written authorization by either a Construction Change Directive or a Change Order.

3.4.5 Whether indicated or not, all products on this project shall be asbestos-free and lead-free. If any suspected asbestos-containing or lead-containing materials are installed, the Owner has the right to have the material in question tested and if proven to contain asbestos or lead, the Contractor shall remove all material in question and replace it with acceptable material at no additional cost to the Owner.

3.4.7 Standards of quality for the work is established by description, by reference to trade name, manufacturer’s names or by catalog model or figure numbers. Such references require that which be established, as standards of quality shall be provided without substitution unless permitted by the contract documents

Paragraph 3.4 **LABOR AND MATERIALS**. Add paragraph 3.4.8 and its subparagraphs 3.4.8.1 and 3.4.8.2 as follows:

3.4.8 Work specified which becomes unavailable due to strike, loss of plant through fire or flood, bankruptcy, or other unforeseeable cause beyond Contractor’s control, shall be substituted equally from another source subject to substitution procedures in the Contract Documents.

3.4.8.1 Work covered by paragraph 3.4.8 shall not entitle the Contractor to either an increase in cost or contract time. Notwithstanding the same, if the work covered by 3.4.8 results in a savings to Contractor, Owner shall be entitled to a reduction in the Contract Sum. In any event,

work covered by paragraph 3.4.8 shall be incorporated into the Project through a properly executed Change Order.

3.4.8.2 Items not ordered by the contractor in a timely manner for incorporation into the Work will not be considered for claims by the Contractor for additional time or costs.

Paragraph 3.5 **WARRANTY**, add subparagraphs 3.5.3 and 3.5.4 as follows:

3.5.3 The minimum Warranty period as defined above, shall be one (1) year from date of substantial completion of the entire project or each phase listed on the Contract Documents. The Contractor is responsible for maintaining all systems that are operational but not fully completed and warranted because they are being used in other phases of the project. These systems include but are not limited to roofing, electrical systems, lighting systems, mechanical systems, plumbing systems, technology and phone systems and general construction systems. Contractor is responsible to obtain any extended warranties necessary to ensure that the full one year warranty is provided from the date of substantial completion of each phase.

3.5.4 The warranty provided in subparagraph 3.5.1 shall be in addition to and not in limitation of any other warranty required by the Contract Documents or otherwise prescribed by law.

Paragraph 3.6 **TAXES**, add subparagraph 3.6.1 as follows:

3.6.1 Contractor shall be responsible for and shall pay all applicable sales, use, excise or other taxes required by law on all materials, tools, apparatus, equipment, fixtures, services, incidentals or otherwise which may be purchased or used in connection with the Work or portions thereof. The Bid shall be made in accordance with such laws and shall include all applicable taxes in the Bid amount. Notwithstanding the foregoing, however, Owner is exempt (excluded) from sales and/or use tax in Pennsylvania on certain transactions. Contractor and all subcontractors shall bid and shall purchase as exempt (excluded) from Pennsylvania sales and/or use tax all tangible personal property within the definition of 'building machinery and equipment' as that term is defined in the Tax Reform Code of 1971, as amended, at 72 P.S. 7201§(pp). No charges shall be allowed for such exempt items. It shall be the Contractor's responsibility to determine those items for which an exemption will apply, and the Contractor shall obtain legal or other tax advice to determine how and to what extent an exemption form the taxes apply. In order to facilitate such purchase free of sales and/or use tax in Pennsylvania, and upon certification by Contractor that an item is, in fact, tax exempt, the owner agrees to execute a tax exemption certificate prepared by Contractor or a subcontractor as may be required by the regulations of the Pennsylvania Department of Revenue.

Paragraph 3.6 **TAXES**, add subparagraphs 3.6.2, 3.6.3 and 3.6.4 as follows:

3.6.2 Access to Accounting Records: The Contractor shall check all materials, equipment and labor entering into the Work and shall keep such full and detailed accounts as may be necessary for proper financial management under this Agreement, and the system shall be satisfactory to the Owner. The Owner or its representative shall be afforded access to all the Contractor's records, books, correspondence, instructions, drawings, receipts vouchers, memoranda, and similar data relating to this Contract, and the Contractor shall preserve all such records for a period of three years, or for such longer period as may be required by law, after the final payment. (AIA Document A111-1978, Article 12).

3.6.3 Assignment of Refund Rights: The Contractor agrees to assign and transfer to the Owner all its rights to sales and use tax which may be refunded as a result of a claim for refund for materials purchased in connection with this contract. The Contractor further agrees that it will not file a claim for refund for any sales or use tax which is the subject of this assignment.

3.6.4 Contracts with Subcontractors: The Contractor agrees to include the "Access to Accounting Records" and "Assignment of Refund Rights" paragraphs, in full, in any contracts with subcontractors.

Paragraph 3.7 **PERMITS, FEES AND NOTICES**, add subparagraphs 3.7.1.1 and 3.7.1.2 as follows:

3.7.1.1 Owner shall pay for building permits required for the project as precedent to construction. The Contractor shall submit, with no markup, the cost of any permits or inspection fees required for the Project. The Owner will reimburse the Contractor, by Change Order with no markup, for fees paid to the municipal authorities having jurisdiction. The Contractor shall secure and arrange for all necessary utility connections and municipal or agency approvals or permits required for the Project.

3.7.1.2 To the extent Contractor pays for any permit, connection and/or tap-in fee not otherwise properly due, the owner shall be entitled to any refund relating thereto and the Contractor agrees to assign any and all rights to said refund claim to the owner. The Contractor and all subcontractors hereby assign to owner all rights to claim any such refund claim and to any resulting refund and hereby appoint to the Owner as Attorney-in-Fact to execute and acknowledge in their respective names and to prosecute such refund claims before administrative agencies and courts in Pennsylvania having jurisdiction over such claims. The Owner or its agent shall have the right to review the books and records of Contractor and all subcontractors for the purpose of documenting and substantiating any such refund claim. Contractor and all subcontractors shall fully cooperate with owner in pursuing any such refund claim and shall make available to owner any applicable documents.

Paragraph 3.10 **CONTRACTOR'S CONSTRUCTION AND SUBMITTAL SCHEDULES**, add the following sub-paragraphs as follows:

3.10.4 The Project Schedule shall be submitted by the Contractor for his work.

3.10.5 The Project Schedule must be developed by the Contractor and must incorporate the milestone, substantial completion and final completion dates as indicated on the contract documents. No deviations from these will be accepted. Should the contractor fail to meet any date, the owner shall pursue liquidated damages and contractor must provide the owner with a recovery schedule.

Paragraph 3.11 **DOCUMENTS AND SAMPLES AT THE SITE** add the following sentence to the text of Paragraph 3.11

The Contractor shall also maintain copies of all testing agency inspection reports, test results, and other documentation associated with required inspections and testing performed during construction, and make such records available to the Architect and Owner upon request. All such records shall be included in the project closeout documentation and delivered to the Architect for submittal to the Owner upon completion of the Work.

Paragraph 3.12 **SHOP DRAWINGS, PRODUCT DATA AND SAMPLES**, add the following subparagraph 3.12.11 as follows:

3.12.11 The Architect's review of Contractor's submittals will be limited to examination of an initial submittal and two (2) resubmittals. The Architect's review of additional submittals will be made only with the consent of the Owner after notification by the Architect. The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect for evaluation of such additional resubmittals.

Paragraph 3.15 **CLEANING UP**, modify subparagraph 3.15.1 as follows:

3.15.1 The Contractor shall keep the premises clean at all times of dirt, rubbish and debris resulting from the work and shall remove all rubbish and debris in metal containers at the end of each working day. The Contractor shall remove all rubbish cartons resulting from the installation of fixtures and equipment. If the premises are not kept clean at all times and if within 24 hours after verbal notice from the Owner the dirt, rubbish, and debris is not cleaned up by Contractor then Owner will arrange for such cleanup at the Contractor's expense. Prior to substantial completion of the Work, the Contractor shall do the cleaning of the surfaces of all his installations as may be required by the various Specifications to the satisfaction of the Architect.

Paragraph 3.15 **CLEANING UP**, add subparagraph 3.15.3 as follows:

3.15.3 The Contractor shall make provisions for and be personally responsible for removing all mud and debris from all vehicles and equipment leaving the construction site onto Municipal streets adjoining the project site and shall remove any debris and litter which may fall upon Municipal streets. If the same is not removed and properly washed down within 24 hours after verbal notice from the Municipality to the Owner, then in that event, said debris and litter shall be removed from the street by the Owner at the Contractor's expense.

Paragraph 3.15 **CLEANING UP**, add subparagraph 3.15.4 as follows:

3.15.4 In readiness for occupancy of the Owner, the Contractor, when directed by the Architect, shall thoroughly clean all portions of the work to be occupied and all applicable material and equipment surfaces suitable for occupancy. Cleaning of windows and other glass in the Project is a contractual requirement.

Paragraph 3.18 **INDEMNIFICATION**, delete subparagraph 3.18.1 in its entirety and replace with the following:

3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify, defend and hold harmless the Owner, Architect and consultants, representatives, agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to, attorneys' fees and defense costs arising out of or resulting from performance of the Work, to the extent caused in whole or in part by the acts or omissions of the Contractor, other Contractors, Prime Contractors, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts or omissions they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Paragraph 3.18. The Contractor agrees to and does hereby assume on behalf of the Owner and Architect the defense of any action at law or in equity which may be brought against such indemnitees by reason of claims for which indemnity is owed hereunder, and will pay on behalf of such indemnitees, upon their demand, the amount of any judgment that may be entered against such indemnitees in any such action.

In the event that any such claim, loss, cost, expense, liability, damage or injury arises or is made, asserted, threatened against the Owner for which the Contractor or its insurer does not admit coverage, or if the Owner reasonably determines such coverage to be inadequate, the Owner shall have the right to withhold from any payments due or to become due to the Contractor an amount sufficient to protect the Owner from such claim, loss, cost, expense, liability, damage or injury, including attorneys' fees and expenses reasonably necessary for the defense thereof.

Add new Paragraph 3.19 **EQUAL EMPLOYMENT OPPORTUNITY** as follows:

3.19.1 During the performance of this contract the Contractor agrees as follows:

(1) The Contractor and the Contractor's Sub-contractors shall not discriminate against any employee or applicant for employment because of race, creed, color, national origin, or other actual or perceived basis protected under state law and the Conshohocken Human Relations Ordinance. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, creed, color, national origin, or other actual or perceived basis protected under state law and the Conshohocken Human Relations Ordinance. Such action shall include, but not be limited to the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination, rates of pay or other forms of compensation and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of the non-discrimination clause.

(2) The Contractor and the Contractor's Subcontractors shall, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that qualified applicants will receive consideration for employment without regard to race, creed, color, national origin, or other actual or perceived basis protected under state law and the Conshohocken Human Relations Ordinance.

(3) Discrimination Prohibited: In accordance with 62 Pa.C.S. § 3701, Contract Provisions Prohibiting Discrimination, the Contractor agrees as follows:

a) In the hiring of employees for the performance of work under this Contract or any Subcontract, neither the Contractor, any Subcontractor, nor any person acting on their behalf shall discriminate against any citizen of the Commonwealth of Pennsylvania who is qualified and available to perform the work to which the employment relates, on account of gender, race, creed, or color.
b) Neither the Contractor, any Subcontractor, nor any person acting on their behalf shall discriminate against or intimidate any employee hired for the performance of work under this Contract on account of gender, race, creed, or color.
c) The Owner may cancel or terminate this Contract, and all money due or to become due under the Contract may be forfeited, for a violation of the terms or conditions of this provision, in accordance with 62 Pa.C.S. § 3701.

ARTICLE 5, SUBCONTRACTORS

Paragraph 5.2 **AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK**: Add subparagraph 5.2.1.1 to subparagraph:

5.2.1.1 Not later than 30 days after the date of the Notice to Proceed, the Contractor shall furnish in writing to the Owner through the Architect the names of persons or entities proposed as manufacturers, fabricators or material suppliers for the products, equipment and systems identified in the Project Specifications and drawings and, where applicable, the name of the installing Subcontractor. The Owner reserves the right to deduct $600.00 from contract amount for each additional day that all information is not furnished.

Paragraph 5.2 **AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK**: Delete subparagraph 5.2.3 and replace with the following:

5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. There shall be no adjustment in the Contract Sum because of such substitution.

Paragraph 5.2 **AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK**: Add new subparagraphs 5.2.3.1, 5.2.3.2 and 5.2.3.3 as follow:

5.2.3.1 Where Contractor sublets portions of the work, the entire responsibility for the subdividing of work rests with the Contractor. The Owner and the Architect are not responsible for the manner of the subdivision of the work and neither will enter into nor settle disagreements or disputes between Contractor and Subcontractors. The arrangement of Specifications and the manner of graphic illustration of Drawings are for convenience of reference and do not comprise any exacting method of subdividing work for purposes of subcontracting, except where the Contract Documents require an undivided responsibility for certain work.

5.2.3.2 Contractor shall require each Subcontractor to (1) Inspect surfaces and job conditions before beginning work at Site, (2) Accept or cite necessary corrections in surfaces and job conditions before beginning work at Site, and (3) Protect his own materials, equipment and work from damage, injury or loss due to weather or due to work of the Contractor, other Subcontractors, or other Contractors. The best means of protection shall be supplied, and removed when no longer required.

5.2.3.3 Contractor shall arrange during the progress of the Work for necessary openings (temporary and permanent) chases, sleeves in walls, floors, ceilings roof and partitions as required by his subcontractors.

Add new Paragraph 5.5 **PAYMENT TO SUBCONTRACTORS** as follows:

5.5 PAYMENT TO SUBCONTRACTORS

5.5.1 The Contractor shall pay each Subcontractor, upon receipt of payment from the Owner, an amount equal to the percentage of completion allowed to the Contractor on account of such Subcontractor's Work, less the percentage retained from payments to the Contractor. The Contractor shall also require each Subcontractor to make similar payments to Sub-subcontractors. All such payments shall be paid within the time limits required by the Pennsylvania Contractor and Subcontractor Payment Act, 73 P.S. §501, et seq.

5.5.2 If the Owner fails to approve an Application for Payment for a cause which the Owner and the Architect determine is the fault of the Contractor and not the fault of the particular Subcontractor, or if the Contractor fails to make payment which is properly due to a particular Subcontractor, the Owner may pay such Subcontractor directly, less the amount to be retained under its Subcontract. Any amount so paid by the Owner shall be repaid to the Owner by the Contractor in the manner set forth in Paragraph 2.5. The Owner shall have no obligation to pay or to see to the payment of any monies to any Subcontractor. Nothing contained in Paragraph 5.5 shall be deemed to create any contractual relationship between the Owner and any Subcontractor or to create any rights in any Subcontractor against the Owner. The Contractor shall promptly advise the Owner of any claim or demand by a Subcontractor claiming that any amount is due to such Subcontractor or claiming any default by the Contractor in any of its obligations to such Subcontractor.

ARTICLE 6, CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

Paragraph 6.1 **OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS**: In subparagraph 6.1.3, delete the words "...and of each Separate Contractor..." from the first sentence.

Paragraph 6.1 **OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS**: Add subparagraphs 6.1.3.1 and 6.1.3.2 as follows:

6.1.3.1 Each separate prime contractor shall be responsible for the coordination of their own Work with the other prime contractors. The General Construction Contractor shall be the coordinating contractor among the prime contractors for the project. All other Prime Contractors shall cooperate and coordinate their Work with the General Construction Contractor. The Coordinating Contractor shall be responsible for making decisions not mutually agreed upon by another prime Contractor. The final construction decision of the Coordinating Contractor shall be at all times consistent with the design intent, the most current agreed upon project schedule and with the agreement of the Owner and Architect. The final decision of the Coordinating Contractor shall be accepted and implemented by the other prime contractors. The progress of the work shall not be delayed or affected pending any such action in accordance with applicable laws.

6.1.3.2 Regarding mechanical and electrical Work on the project, and subject to the overall responsibility of the Lead Contractor in connection with all of the Work, each separate Prime Contractor shall be responsible for the coordination of their own Work with the other Prime Contractors, and for observing the requirements set forth in Division 01. The coordination of mechanical and electrical Work shall also be subject to the responsibility of the Lead Contractor in connection with the rendering of final construction decisions. Such responsibility shall however be invoked only after the provisions of Section 6.1.3.1Division 1 have been fully observed.

Paragraph 6.2 **MUTUAL RESPONSIBILITY**, delete paragraph 6.2.3 in its entirety and replace with the following:

6.2.3 Cost caused by delays or improperly timed activities or defective construction shall be borne by the parties responsible therefor, excepting however, Owner and Architect who shall not be liable to any Contractor, subcontractor or sub-subcontractor for claims or damages of monetary or other nature caused by or arising out of delays contemplated or not contemplated at the signing of the contract. The sole remedy against the Owner for delays shall be the allowance to a successful claimant of additional time for completion of work.

Paragraph 6.2 **MUTUAL RESPONSIBILITY**, Paragraph 6.2.4, add the following:
"The Contractor agrees to indemnify and hold the Owner and Architect harmless from any claims or damages brought by a separate Contractor arising out of actions or omissions of the Contractor, its Subcontractors or suppliers in performing their Work under the Contract Documents."

Paragraph 6.2 **MUTUAL RESPONSIBILITY**, Paragraph 6.2.4, add new subparagraphs 6.2.4.1 and 6.2.4.2 as follows:

6.2.4.1 Should the Contractor wrongfully cause damage to the work or property of any separate contractor, the Contractor shall, upon due notice, promptly attempt to settle with the separate contractor by agreement, or otherwise to resolve the dispute. Such dispute shall not delay the completion of the Work. Work shall be continued by the separate contractor claiming damages at his expense subject to his right to recover damages. If such separate contractor sues the Owner or the Architect on account of any damage alleged to have been caused by the Contractor, the Owner or Architect shall notify the Contractor who shall defend such proceedings at the Contractor's expense, and if any judgment or award against the Owner or Architect arises therefrom the Contractor shall pay or satisfy it and shall reimburse the Owner, Owner's Representative or Architect for all attorneys' fees and court costs which the Owner, Owner's Representative or Architect has incurred.

6.2.4.2 The Contractor shall promptly remedy damage wrongfully caused by the Contractor to completed or partially completed construction or to property of the Owner or separate contractors. The Contractor agrees to indemnify and hold the Owner harmless from any claims or damages brought by a separate Contractor arising out of actions or omissions of the Contractor, its subcontractors or suppliers in performing their work under the Contract Documents.

ARTICLE 7, CHANGES IN THE WORK

Paragraph 7.1 **GENERAL**, add the following to subparagraph 7.1.2:

The agreement required by the Owner for Change Orders and Construction Change Directives shall be in the form of a majority vote of the Borough Council of the Borough of Conshohocken at a duly authorized public meeting.

Paragraph 7.1 **GENERAL**, delete subparagraph 7.1.3 and replace with the following:

7.1.3 Before any Change Order is prepared, the Contractor shall submit to the Architect, an itemized breakdown of the cost of the proposed Change in the Work. The term "cost" shall be interpreted to mean and include the actual cost of the following:

(1) Labor, including foremen.
(2) Materials at cost plus applicable taxes entering permanently into the work.
(3) Rental cost of construction plant and equipment whether rented from the Contractor or others.
(4) Power and consumable supplies for the operation of power equipment.
(5) Liability insurance and bonds.
(6) Social security, old age and unemployment contributions.

Paragraph 7.1 **GENERAL**, add the following subparagraph 7.1.4:

7.1.4 The combined overhead and profit included in the total cost to the Owner of a change in the Work shall be based on the following schedule:

(1) For the Contractor, for Work performed by the Contractor's own forces, 15 percent of the cost.

(2) For the Contractor, for work performed by the Contractor's Subcontractor, 10 percent of the amount due the Subcontractor.

(3) For each Subcontractor or Sub-Subcontractor involved, for work performed by that Subcontractor's or Sub-subcontractor own forces, 15 percent of the cost.

(4) For each Subcontractor, for Work performed by the Subcontractor's Sub-subcontractors, 10 percent of the amount due the Sub-subcontractor.

(5) Cost to which overhead and profit is to be applied shall be determined in accordance with Subparagraph 7.3.4.

(6) In order to facilitate checking of quotations for extras or credits, all bids, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials and Subcontracts. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are Subcontracts, they shall be itemized also. In no case will a change involving over $500 be approved without such itemization.

Paragraph 7.1 **GENERAL**, add the following subparagraph 7.1.5 as follows:

7.1.5 Matters involving extra work and changes in the work are subject to the following provisions:

7.1.5.1 Owner reserves the right to accept or reject Contractor’s price, and in instances of more than one price to accept one or more prices or reject one or more or all prices. Contractor may not make a charge of any kind regarding proposed extra work or proposed changes in the Work that were not accepted.

7.1.5.2 Contractor agrees that prices for changes in the Work and for extra work will not include charges involving penalties or damages for assumed delays in the Work, charges for estimating, cancellation charges on prior rejected work, and similar amounts which do not relate directly to costs of labor and material and equipment appurtenant to work involved.

7.1.5.3 Unless Contract Time must be unchanged and is so stated in the applicable Change Order or Construction Change Directive, extra time granted to Contractor because of extra work or changes in the Work shall be final, without penalty regarding the essence of time in the Contract.

7.1.5.4 No charges by Contractor for extra work or changes in the Work, nor claims on account thereof, shall be valid unless duly authorized pursuant to the procedure herein described. Written authority to perform extra work or changes in the Work must be in possession of Contractor before such work commences in order that Contractor’s right to payment on account thereof may be valid.

7.1.5.5 All Change Orders shall be accompanied by detailed price breakdowns.

7.1.5.6 Owner reserves the right to contract with a separate Contractor to perform any extra Work or to perform such Work with its own forces.

Paragraph 7.2 **CHANGE ORDERS**, add new subparagraph 7.2.2 as followings:

7.2.2 In order to facilitate checking of quotations for adjustments in the Contract Sum, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including, labor, materials, and subcontracted. Labor and materials shall be itemized in the manner prescribed above. When major cost items are subcontracted, these costs shall be itemized also.

Paragraph 7.3 **CONSTRUCTION CHANGE DIRECTIVES**, modify sub-paragraph 7.3.4 by deleting the words "an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount" and substitute "an allowance for overhead and profit in accordance with Subparagraph 7.1.4"

ARTICLE 8, TIME

Paragraph 8.1 **DEFINITIONS**, add Subparagraph 8.1.5 as follows:

8.1.5 The Project Schedule as used in the Contract Documents is the written approved schedule by the Contractor (s), and it shall be, with respect to time, of the essence under the contract. The Project Schedule may be changed or revised only with the written consent of all separate Contractors and the Owner.

Paragraph 8.3 **DELAYS AND EXTENSIONS OF TIME**, Paragraph 8.3.1, add new subparagraph 8.3.1.1 as follows:

8.3.1.1 No extension of Contract Time will be considered or approved if the act or occurrence constituting the basis of the request or claim is for non-delivery of materials due to any act or neglect of the Contractor, or the failure of the Contractor to employ, furnish or obtain, as necessary for the timely prosecution of the work, shop drawings, sufficient labor, materials or equipment, or other matters which shall be within the control of the Contractor. Any delay which results due to any of the foregoing causes shall be the sole responsibility of the Contractor.

Paragraph 8.3 **DELAYS AND EXTENSIONS OF TIME**, delete subparagraph 8.3.3 and replace with the following:

8.3.3 The Contractor recognizes that delays, acceleration or hindrances may occur. No claims for increased costs, charges, expenses or damages of any kind, shall be made by the contractor against the Owner and Architect for any delays, acceleration, hindrances or sequencing of work from any cause whatsoever, including but not limited to, strikes, walkouts, extended overhead, winter protection or work stoppages during the progress of any portion of the work, notwithstanding whether such delays be avoidable or unavoidable. The contractor's sole remedy for delays, acceleration, hindrances or sequencing of work shall be an extension of Contract Time, pursuant to and only in accordance with this Paragraph 8.3. Such extension shall be a period equivalent to the time lost, day for day, by reason of any and all of the aforesaid causes. All claims for extension of time for delays, acceleration, hindrances or sequencing of work shall be made, in writing, to the Architect, and Owner no more than seven (7)

calendar days after the occurrence of the delay, acceleration or hindrance. A written request for an extension of time shall be a condition precedent to the contractor's right to claim an extension of time.

Paragraph 8.3 **DELAYS AND EXTENSIONS OF TIME**, add new paragraph 8.3.4, 8.3.5 and 8.3.6 as follows:

8.3.4 Notwithstanding anything to the contrary in the Contract Documents, an extension in the contract time, to the extent permitted under this paragraph 8.3, shall be the sole remedy of the Contractor for (1) delay in the commencement, prosecution or completion of the work; (2) hindrance or obstruction in the performance of the work; (3) loss of productivity; or (4) other similar claims (collectively referred to in this subparagraph as delays) whether or not such delays are foreseeable, unless a delay is caused by the acts of the Owner constituting active interference with the Contractor's performance of the work, and only to the extent that such acts continue after the Contractor furnishes the Owner with written notice of such interference. In no event shall the Contractor be entitled to any compensation or recovery of any damages, in connection with any delay, including, without limitation, consequential damages, lost opportunity cost, impact damages or similar remuneration. The Owner's exercise or failure to exercise any rights or remedies under the Contract Documents (including without limitation, ordering changes in the work, or directing suspension, rescheduling or correction of the work), regardless of the extent or frequency thereof, shall not be construed as active interference with the Contractor's performance of the work.

8.3.5 No payment or compensation or claim for damages shall be made to the Contractor as compensation for damages for any delays or hindrances from any cause whatsoever in the progress of the Work, or for acceleration or advancement of the Work in accordance with the accepted construction schedule and revisions thereto, notwithstanding whether such delays be avoidable or unavoidable. The Contractor's sole remedy for delays shall be an extension of time only, pursuant to and only in accordance with this Paragraph 8.3, such extension to be a period equivalent to the time lost by reason of any and all of the aforesaid causes. In consideration for this grant of a time extension, the Owner and Architect shall not be held responsible for any loss or damage or increased costs sustained by the Contractor through any delays caused by the Owner or Architect or any other Prime Contractor or on account of the aforesaid causes or any other cause of delay or acceleration. In the event the Contractor shall choose to litigate this clause or issue and a final decision adverse to Contractor is rendered in the litigation, the Contractor shall reimburse the Owner and the Architect for their reasonable attorney's and expert witness fees and all other costs and expenses incurred by them in the litigation.

8.3.6 It shall be recognized by the Contractor that he may reasonably anticipate that as the job progresses, the Lead Contractor will be making changes in and updating the Construction Schedule pursuant to Paragraph 3.10. Therefore, no claim for an increase in the Contract Sum for either acceleration or delay will be allowed for extensions of time pursuant to this paragraph or for other changes in the Construction Schedules which may be experienced.

ARTICLE 9, PAYMENTS AND COMPLETION

Paragraph 9.3 **APPLICATIONS FOR PAYMENT**, delete sub-paragraph 9.3.1 in its entirety and replace with the following:

9.3.1 At least fifteen (15) days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment for Work completed in accordance with the Contract Documents. Such application shall be notarized, if required, and supported by such data

substantiating the Contractor's right to payment as the Owner or Architect may require, such as copies of requisitions from Subcontractors and material suppliers and reflecting retainage.

9.3.1.1 The Owner shall retain ten percent (10%) of all amounts due the Contractor until the Work is fifty percent (50%) completed. When the Work is fifty percent (50%) completed, one-half of the amount retained by the Owner may be returned to the Contractor, provided the Contractor provides written consent of surety to such reduction in retainage to Owner along with its Application for Payment, provided the Architect approved the application and reduction of retainage, and further provided that the Contractor is making satisfactory progress and there is no specific cause for greater withholding.

9.3.1.2 The Owner shall retain five percent (5%) of all amounts due the Contractor after the Work is fifty percent (50%) completed. The retained five percent (5%) will be paid with the final Payment or as otherwise provided hereafter. In the event a dispute arises between the Owner and the Contractor, which dispute is based upon increased costs claimed by the Contractor occasioned by damages or other actions of another contractor, additional retainage in the sum of one and one half times the amount of any possible liability may be withheld until such time as a final resolution is agreed to by all parties directly or indirectly involved, unless the contractor causing the additional claim furnishes a bond satisfactory to the Owner to indemnify the Owner against the claim.

9.3.1.3 The full Contract retainage may be reinstated if the manner of completion of the Work and its progress do not remain satisfactory to the Owner, Architect or if Surety withholds its consent or for other good and sufficient reasons.

9.3.1.4 "When a Surety is involved, submit their consent in triplicate on AIA form G707A "Consent of Surety to Reduction in or Partial Release of Retainage."

Paragraph 9.3 **APPLICATIONS FOR PAYMENT**, delete paragraph 9.3.2 and replace with the following:

9.3.2 Stored Materials:

9.3.2.1 Materials Stored On Site. Materials properly stored at the construction site may be included in the Contractor's application for payment, subject to the following conditions: (1) All materials shall be stored in strict compliance with the manufacturer's recommendations in secure, dry enclosures; (2) Contractor shall provide property insurance covering materials stored at the construction site to the extent that Owner's property insurance does not provide coverage; (3) Contractor shall provide an accurate inventory of all materials included for payment with each application for payment. Contractor shall maintain the inventory until the materials are installed or otherwise incorporated into the work; and (4) Payment for materials stored on the construction site shall be limited to the actual, invoiced cost to the Contractor, F.O.B. the construction site. Contractor shall warrant that all suppliers are promptly paid in full for all materials included for payment and that materials are not encumbered by any lien, claim or mortgage that would prevent the Owner from taking full possession of the materials. Contractor shall produce satisfactory evidence of same to Owner.

9.3.2.2 Materials Stored Off Site. Materials stored off the construction site shall not be included for payment in the Contractor's application for payment unless prior approval of the Owner has been obtained. Payment for materials stored off the construction site shall be

subject to the conditions in subparagraph 9.3.2.1. and the following additional conditions: (1) Contractor shall provide property insurance for the full cost of the materials stored off the construction site; (2) Contractor shall provide a bill of sale for the materials granting clear title to the materials to the Owner; (3) Contractor shall pay all storage costs, shall be responsible for any damage or deterioration of the materials while in storage or in transit to the construction site and shall pay the cost of inspection of the materials in storage by the Owner. Contractor shall be responsible for and shall pay all costs of transportation of the materials to the construction site. (4) Contractor shall provide a bond for stored materials if required by the Owner.

Paragraph 9.3 **APPLICATIONS FOR PAYMENT**, add new paragraph 9.3.4 as follows:

9.3.4 No separate payment will be made for submittal preparation.

Paragraph 9.4 **CERTIFICATES FOR PAYMENT**, add following subparagraph 9.4.3:

9.4.3 Provided the Contractor's Applications for Payment is received by the Architect not later than the last day of the month, the Owner shall make payment to the Contractor not later than the 29th day of the following month. If an Application for Payment is received by the Architect after the application date fixed above, payment shall be made by the Owner not later than 21 days after the next payment period."

Paragraph 9.5 **DECISION TO WITHHOLD CERTIFICATION**, add the following subparagraphs, 9.5.1.8 and 9.5.1.9:

9.5.1.8 Failure to comply with government statutes, regulations and laws or

9.5.1.9 Failure to comply with any of the project schedule or scheduling requirements of the contract documents.

Paragraph 9.6 **PROGRESS PAYMENTS**, delete subparagraph 9.6.3 in its entirety and replace with the following:

9.6.3 Contractor and each subcontractor shall comply with the payment provisions of Section 3933 of the Pennsylvania Commonwealth Procurement Act, 62 Pa.C.S. § 3933.

Paragraph 9.6 **PROGRESS PAYMENTS**, subparagraph 9.6.5, delete the reference to subparagraph "9.6.3".

Paragraph 9.7 **FAILURE OF PAYMENT**, add new subparagraph 9.7.1 as follows:

9.7.1 The Contractor shall not stop work or terminate the Contract if the Architect should refuse to issue any certificate because the Application for Payment does not conform with requirements of Paragraphs 9.3, 9.4, 9.5 and/or 9.6 of the General and/or Supplementary Conditions.

Paragraph 9.8 **SUBSTANTIAL COMPLETION**, add the following Subparagraph 9.8.1.1:

9.8.1.1 The Work shall be Substantially Complete when all systems, including but not limited to electrical, HVAC, plumbing, etc., are fully operational and the Work will pass inspection to secure a Certificate of Occupancy from the State and local authorities. Substantial completion shall include a temporary or permanent Certificate of Occupancy from the Authority Having Jurisdiction.

Paragraph 9.8 **SUBSTANTIAL COMPLETION**, add the following clause 9.8.3.1 to Subparagraph 9.8.3:

9.8.3.1 Except with the consent of the Owner, the Architect will perform no more than two (2) inspections to determine whether the Work or a designated portion thereof has attained Substantial Completion in accordance with the Contract Documents. The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect for any additional inspections.

Paragraph 9.8 **SUBSTANTIAL COMPLETION**, add following subparagraphs 9.8.6, 9.8.7, 9.8.8 and 9.8.9:

9.8.6 A Certificate for Payment shall be submitted after the date of Substantial Completion in the amount of one hundred percent (100%) of the Contract amount, less an amount that is required to complete or correct the work, multiplied by 1.5. The amount withheld will be based on the list of work to be completed or corrected and shall be certified by the Architect.

9.8.7 When a surety is involved, neither payment nor retainage shall become due until the Contractor submits to the Architect in triplicate the following:

(1) AIA form G707A "Consent of Surety to Reduction in or Partial Release of Retainage."

9.8.8 In no case shall the time established for the completion and correction of items on the list extend beyond sixty (60) days after certification of substantial completion, except for delay beyond the Contractor's control. The Contractor shall pay for all architectural and consultant services incurred thereafter due to the failure of Contractor to complete and/or correct the work on the list or to submit documentation and items required for final completion and final payment.

9.8.9 Upon Substantial Completion of the Work or designated portion thereof, application by the Contractor and certification by the Architect, the Owner, shall within forty-five (45) days thereof, make payment to Contractor in the full Contract Sum less one and a half (1-½) times such amount that is required to complete and/or correct any then remaining items, which amount shall be certified by the Architect.

Paragraph 9.9 **PARTIAL OCCUPANCY OR USE**, add new paragraph 9.9.4 as follows:

9.9.4 The Contractor shall not withhold Partial Occupancy or Use from the Owner due to failure by the Contractor to complete the work in accordance with the Contract Documents in the time stipulated in the Agreement and approved Change Orders for extension of time.

Paragraph 9.10 **FINAL COMPLETION AND FINAL PAYMENT**, add the following subparagraph 9.10.1.1 to paragraph 9.10.1:

9.10.1.1 Except with the consent of the Owner, the Architect will perform no more than two (2) inspections to determine whether the Work or a designated portion thereof has attained Final Completion in accordance with the Contract Documents. The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect for any additional inspections.

Paragraph 9.10 **FINAL COMPLETION AND FINAL PAYMENT**, add the following subparagraphs 9.10.2.1 to paragraph 9.10.2:

9.10.2.1 Compliance with paragraph 9.10.2 shall be submitted in triplicate as follows:

(1) AIA form G706 "Contractor's Affidavit of Payment of Debts and Claims".
(2) Standard Accord Certificate of Insurance Form 25-S (7/90), if required.
(3) AIA form G715 "Supplemental Attachment" for the Acord Certificate of Insurance Form. (if required).
(4) Letter from Contractor on Letterhead requesting release of retainage.
(5) AIA form G707 "Consent of Surety to Final Payment" (only when Surety is involved).
(6) AIA form G706A "Contractor's Affidavit of Release of Liens".
(7) Final “as built” prints of record drawings marked by the Contractor with record information as set forth in the Contract Documents, and
(8) A final Contractor’s sworn statement from the Contractor duly executed and acknowledged, showing all Subcontractors to be fully paid and similar final sworn statements from Subcontractors and, where appropriate, from Sub-subcontractors.

Paragraph 9.10 **FINAL COMPLETION AND FINAL PAYMENT**, Subparagraph 9.10.4, add the following item 9.10.4.5:

9.10.4.5 Matters arising following such payment, which were not within the reasonable contemplation of Owner when payment was made.

Add the following Paragraph 9.11 **LIQUIDATED DAMAGES** to Article 9 as follows:

9.11 LIQUIDATED DAMAGES:

9.11.1 Actual damages for delay in the time of completion are impossible of determination, thus, said sum is measure only of liquidated damages the Owner will sustain for each delay. Accordingly, the Contractor and the Contractor’s Surety shall be liable for, and shall pay to the Owner as fixed, agreed and liquidated damages, the sum indicated for each calendar day which the actual time of completion included as part of the contract documents and Form of Agreement. All areas are scheduled to be substantially completed on or before the date as indicated on the contract documents and of the Form of Agreement. The Contractor and the Contractor’s Surety shall also be liable for failure to correct “Punch List” items within the time limit indicated.

9.11.2 The actual time of completion shall be the date upon which the work is substantially complete in accordance with provisions of the specifications.

9.11.3 The Owner shall have the right to deduct the total amount of any fixed, agreed and liquidated damages for which the Contractor may be liable from any moneys otherwise due to the Contractor under the contract, including any retained percentage which may be under the control of the Owner.

9.11.4 The surety upon the contract bonds furnished by the Contractor shall be liable for any fixed, agreed and liquidated damages for which the Contractor may be liable under this section to the extent that the Contractor shall not make settlement thereof with the Owner.
9.11.5 Liquidated damages for failure to meet substantial completion for each phase or identified milestone shall be calculated at the following rates for each calendar day (Sundays and holidays included) of delay until the work is substantially complete.

General Construction Contract	Two Thousand, Five Hundred Dollars ($2,500) per day
Mechanical Construction Contract	One Thousand, Five Hundred Dollar ($1,500) per day
Electrical Construction Contract	One Thousand, Five Hundred Dollar ($1,500) per day
Plumbing Construction Contract	One Thousand, Five Hundred Dollar ($1,500) per day

9.11.6 Liquidated damages for failure to correct “Punch List” items shall be calculated at the following rates for each calendar day of delay beyond thirty (30) calendar days after certification of substantial completion until work for corrections is complete.

Five Hundred Dollars ($500) per day for all contracts.

ARTICLE 10, PROTECTION OF PERSONS AND PROPERTY

PARAGRAPH 10.1, **SAFETY PRECAUTIONS AND PROGRAMS**, add the following new subparagraphs 10.1.1, 10.1.2 and 10.1.3:

10.1.1 Contractor shall notify the Environmental Protection Agency prior to renovation operations in which more than 260 lineal feet or 160 square feet of regulated asbestos-containing material is stripped or removed from facility components, and prior to all demolition operation regardless of the amount of asbestos in the facility-including zero.

10.1.2 In lieu of any existing products known to contain hazardous materials (asbestos, lead paint etc) and are scheduled to be removed, should any Contractor encounter asbestos, lead paint, hazardous materials or suspect the presence of such in a material, he shall immediately stop work and notify the Owner who shall then take action for its removal.

10.1.3 The Owner, Owner's Representative and the Architect make no representation regarding the possible presence of hazardous materials, including but not limited to asbestos, polychlorinated biphenyl (PCB) and lead based paints within the area of construction. It is the Contractor's sole responsibility to implement any and all necessary test procedures and precautions against such possibility and to strictly follow and enforce all municipal, state and federal regulations regarding any hazardous material and safe work place practices and hazardous material disposal.

PARAGRAPH 10.2, **SAFETY OF PERSONS AND PROPERTY**, Add new sub-paragraph 10.2.2.1 as follows:

10.2.2.1 If the Contractor fails to give such notices, or fails to comply with such laws, ordinances, rules, regulations and lawful orders, it shall be liable for and shall indemnify and hold harmless the Owner and the Architect, and their respective employees, officers and agents, against any resulting fines, penalties, judgments or damages, including reasonable attorney's fees, imposed on or incurred by the parties indemnified hereunder."

PARAGRAPH 10.2, **SAFETY OF PERSONS AND PROPERTY**, Add new sub-paragraph 10.2.4.1 as follows:

10.2.4.1 When use or storage of explosives or other hazardous materials, substances or equipment or unusual methods are necessary, the Contractor shall give the Owner reasonable advance notice."

PARAGRAPH 10.2 SAFETY OF PERSONS AND PROPERTY, Add new paragraphs 10.2.9, 10.2.10, 10.2.11 and 10.2.12 as follows:

10.2.9 The Contractor shall provide and maintain in good operating condition suitable and adequate fire protection equipment and services, and shall comply with all reasonable recommendations of the fire insurance company carrying insurance on the Work or by the local fire chief or fire marshal. The area within the site limits shall be kept orderly and clean and all combustible rubbish shall be promptly removed from the site.

10.2.10 The Contractor shall at all times protect excavations, trenches, buildings and materials from rainwater, ground water, back up or leakage of sewers, drainage or other piping, and from water of any other origin and shall remove promptly any accumulation of water. Contractor shall provide and operate all pumps, piping and other equipment necessary to this end.

10.2.11 The Contractor shall remove snow or ice which may result in damage or delay.

10.2.12 The Contractor shall take all precautions necessary to prevent loss or damage caused by vandalism, theft, burglary, pilferage, or unexplained disappearance of property of the Owner, whether forming part of the Work, located within those areas of the Project to which the Contractor has access. The Contractor shall have full responsibility for the security of such property of the Owner located in such areas and shall reimburse the Owner for any such loss, damage or injury, except such as may be directly caused by agents or employees of the Owner.

Paragraph 10.3 **HAZARDOUS MATERIALS**, delete subparagraphs 10.3.1, 10.3.2 and 10.3.3 and replace with the following:

10.3.1 In the event the Contractor encounters on the site material reasonably believed to be asbestos or polychlorinated biphenyl (PCB) or other hazardous or toxic substance which have not been rendered harmless, the Contractor shall immediately stop the Work in the area affected and report the condition to the Owner and Architect in writing. The Work in the affected areas shall not thereafter be resumed except by written agreement of the Owner and Contractor if in fact the material is asbestos or polychlorinated biphenyl (PCB) or other hazardous or toxic substance and has not been rendered harmless. The Work in the affected areas shall be resumed in the absence of asbestos or polychlorinated biphenyl (PCB) or other hazardous or toxic substance, or when it has been rendered harmless and removed, by written agreement of the Owner and Contractor, or in accordance with the final determination by the Architect, or in accordance with an appropriate court order, as the case may be.

10.3.2 The Contractor shall not be required pursuant to Article 7 to perform without consent any work relating to asbestos or polychlorinated biphenyl (PCB) or other hazardous or toxic substance.

10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Architect, Architect's consultants and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorney's fees, arising out of or resulting from performance of the Work in the affected area if in fact the material is asbestos or polychlorinated biphenyl (PCB) or other hazardous or toxic substance and has not been rendered harmless, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) including loss of use resulting there from, but only to the extent caused in whole or in part by negligent acts or omissions of the Owner. Such obligation shall not be construed to negate, abridge, or reduce other

rights or obligations of indemnity which would otherwise exist as to a party or person described in this paragraph 10.3.3.

Paragraph 10.3 **HAZARDOUS MATERIALS**, add the following to paragraph 10.3.4:

"The Owner, Owner's Representative and the Architect make no representation regarding the possible presence of hazardous materials, including but not limited to asbestos, polychlorinated biphenyl (PCB) and lead based paints within the area of construction,. It is the Contractor's sole responsibility to implement any and all necessary test procedures and precautions against such a possibility and to strictly follow and enforce all municipal, state and federal regulations regarding any hazardous material and safe work place practices and hazardous material disposal.

Add new paragraph 10.5 DEMOLITION **AND RENOVATION OPERATIONS** and new subparagraph as follows:

10.5 DEMOLITION AND RENOVATION OPERATIONS

10.5.1 To protect persons and property, the Contractor shall take all necessary precautions during demolition and renovation operations to locate and discontinue or otherwise identify and protect existing utilities; to maintain the structural integrity of the building, and to protect the interior contents of the building during construction operations.

10.5.2 All demolition work shall be done by qualified tradesmen from each respective trade, especially in the areas of structural, mechanical and electrical demolition.

ARTICLE 11, INSURANCE AND BONDS

Delete Article 11 **INSURANCE AND BONDS** in its entirety and replace with the following:

11.1 - General Insurance Requirements

11.1.1 - The Contractor shall not commence the Project until the Contractor has obtained at the Contractor's own expense all of the insurance as required hereunder and such insurance has been approved by the Owner; nor shall the Contractor allow any Subcontractor to commence work on any subcontract until all insurance required of the Subcontractor has been so obtained and approved by the Owner. Approval of insurance required of the Contractor will be granted only after submission to the Owner of original certificates of insurance signed by authorized representatives of the insurers or, at the Owner's request, certified copies of the required insurance policies.

11.1.2 - Insurance as required hereunder shall be in force throughout the term of the Contract and for two years after final acceptance of the Project by the Owner in accordance with 11.3.1.1.iv. Original certificates signed by authorized representatives of the insurers or, at the Owner's request, certified copies of insurance policies, evidencing that the required insurance is in effect, shall be maintained with the Owner throughout the term of the Contract and for two years after final acceptance of the Project by the Owner.

11.1.3 - The Contractor shall require all Subcontractors to maintain during the term of the Contract commercial general liability insurance, business auto liability insurance, and workers compensation, employers liability insurance to the same extent required of the Contractor in 11.3.1.1, 11.3.1.2, and 11.3.1.3 unless any such requirement is expressly waived or amended by the Owner in writing. The Contractor shall furnish Subcontractors' certificates of insurance to the Owner immediately upon request.

11.1.4 - All insurance policies required hereunder shall be endorsed to provide that the policy is not subject to cancellation or non-renewal until sixty (60) days prior written notice has been given to the Owner.

11.1.5 - No acceptance and/or approval of any insurance by the Owner shall be construed as relieving or excusing the Contractor or the Contractor's Surety from any liability or obligation imposed upon either or both of them by the provisions of this Contract.

11.1.6 - If the Contractor does not meet the insurance requirements of this Contract, the Contractor shall forward a written request to the Owner for a waiver in writing of the insurance requirement(s) not met or approval in writing of alternate insurance coverage, self-insurance, or group self-insurance arrangements. If the Owner denies the request, the Contractor must comply with the insurance requirements as specified in this Contract.

11.1.7 - All required insurance coverages must be underwritten by insurers allowed to do business in the Commonwealth of Pennsylvania and acceptable to the Owner. The insurers must also have a policyholders' rating of "A-" or better, and a financial size of "Class VII" or better in the latest evaluation by A. M. Best Company, unless the Owner grants specific approval for an exception. The Owner hereby grants specific approval for the acquisition of workers compensation and employers liability insurance from the State Workers' Insurance Fund (SWIF) of Pennsylvania.

11.1.8 - Any deductibles or retentions in excess of $10,000 shall be disclosed by the Contractor, and are subject to the Owner's written approval. Any deductible or retention amounts elected by the Contractor or imposed by the Contractor's insurer(s) shall be the sole responsibility of the Contractor.

11.1.9 - Any and all return premiums and/or dividends for insurance or coverage directly charged to the Owner by the Contractor in connection with this Contract shall belong to and be payable to the Owner.

11.1.10 - If the Owner is damaged by the failure or neglect of the Contractor to purchase and maintain insurance as described and required herein, without so notifying the Owner, then the Contractor shall bear all reasonable costs properly attributable thereto.

11.2 – Owner's Liability Insurance

11.2.1 - The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance, or solely at the Owner's option, the Owner may self-insure the Owner's liability exposures.

11.3 - Contractor's Liability Insurance

11.3.1 - The Contractor shall purchase and maintain the following insurance coverages which will insure against claims which may arise out of or result from the Contractor's operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable. Insurance shall be written for not less than the limits specified below or required by law, whichever is greater.

11.3.1.1 - Commercial general liability insurance or its equivalent for bodily injury, personal injury and property damage including loss of use, with minimum limits of:

$ 1,000,000 each occurrence;
$ 1,000,000 personal and advertising injury;
$ 2,000,000 general aggregate; and
$ 2,000,000 products/completed operations aggregate.

This insurance shall include coverage for all of the following:

i. General aggregate limit applying on a per project basis;
ii. Liability arising from premises and operations;
iii. Liability arising from the actions of independent contractors;
iv. Liability arising from products and completed operations with such coverage to be maintained for two years after completion of the Project;
v. Contractual liability including protection for the Contractor from bodily injury and property damage claims arising out of liability assumed under this Contract; and
vi. Liability arising from the explosion, collapse, or underground (XCU) hazards.

11.3.1.2 - Business auto liability insurance or its equivalent with a minimum limit of $1,000,000 per accident and including coverage for all of the following:

i. Liability arising out of the ownership, maintenance or use of any auto; and
ii. Automobile contractual liability.

11.3.1.3 - Workers compensation insurance or its equivalent with statutory benefits as required by any state or Federal law, including standard "other states" coverage; employers liability insurance or its equivalent with minimum limits of:

$ 500,000 each accident for bodily injury by accident;
$ 500,000 each employee for bodily injury by disease; and
$ 500,000 policy limit for bodily injury by disease.

11.3.1.4 - Umbrella excess liability or excess liability insurance or its equivalent with minimum limits of:

$ 5,000,000 per occurrence;
$ 5,000,000 aggregate for other than products/completed operations and auto liability; and
$ 5,000,000 products/completed operations aggregate

and including all of the following coverages on the applicable schedule of underlying insurance:

i. Commercial general liability;
ii. Business auto liability; and
iii. Employers liability.

11.3.1.5 – Contractors pollution liability insurance or its equivalent for bodily injury, property damage, including loss of use, and cleanup costs on and off the Project site, with minimum limits of:

$ 1,000,000 each pollution incident; and
$ 1,000,000 annual aggregate.

11.3.1.6 - The Owner and its elected and appointed officials, directors, officers, consultants, agents and employees shall be named as additional insureds on the Contractor's commercial general liability insurance and umbrella excess or excess liability insurance policies with respect to liability arising out of the Contractor's work under this Contract. Such coverage shall extend to cover the additional insured(s) for liability arising out of the following:

i. On-going operations; and
ii. Completed operations.

The commercial general liability policy and the umbrella excess liability or excess liability policies, if required herein, must include additional insured language, which shall afford liability coverage for the exposures listed above in i. and ii.

***Special Note*:** Policies endorsed with the following combinations of ISO forms shall be acceptable:

- **CG 2010** entitled "Additional Insured - Boroughs, Lessees or Contractors – Scheduled Person or Organization" and **CG 2037** entitled "Additional Insured - Boroughs, Lessees or Contractors – Completed Operations";

OR

- **CG 2033** entitled "Additional Insured - Boroughs, Lessees or Contractors - Automatic Status When Required in Construction Agreement With You" and **CG 2037** entitled "Additional Insured - Boroughs, Lessees or Contractors – Completed Operations".

***Both** endorsements are required to afford coverage to the additional insured for both on-going operations and completed operations.* Additionally, the schedules on these endorsements must properly reference the Owner and the Owner's elected and appointed officials, officers, consultants, agents and employees.

11.3.1.7 - Insurance or self-insurance provided to the Owner and its elected and appointed officials, directors, officers, consultants, agents and employees under any Contractor's liability insurance or self-insurance required herein, including, but not limited to, umbrella and excess liability or excess liability policies, shall apply separately to each insured against whom claim is

made or suit is brought, except with respect to the limits of insurance or self-insurance. (Any cross suits or cross liability exclusion shall be deleted from Contractor's liability insurance policies required herein.)

11.3.1.8 - Insurance or self-insurance provided to the Owner and its elected and appointed officials, directors, officers, consultants, agents and employees as specified herein shall be primary, and any other insurance, self-insurance, coverage or indemnity available to the Owner and its elected and appointed officials, directors, officers, consultants, agents and employees shall be excess of and non-contributory with insurance or self-insurance provided to the Owner and its elected and appointed officials, directors, officers, consultants, agents and employees as specified herein.

11.3.2 - If any liability insurance purchased by the Contractor has been issued on a "claims made" basis, the Contractor must comply with the following additional conditions:

i. The Contractor shall agree to provide certificates of insurance evidencing the above coverages for a period of two years after final payment for the Contract. Such certificates shall evidence a retroactive date no later than the beginning of the Project under this Contract; ***or***

ii. The Contractor shall purchase an extended (minimum two years) reporting period endorsement for each such "claims made" policy in force as of the date of final acceptance and evidence the purchase of this extended reporting period endorsement by means of a certificate of insurance or a copy of the endorsement itself. Such certificate or copy of the endorsement shall evidence a retroactive date no later than the beginning of the Project under this Contract.

11.4 - Builders Risk Insurance

11.4.1 - The Owner shall purchase and maintain builders risk insurance on a replacement cost basis with a limit at least equal to the Contract Sum. This insurance shall be maintained until final acceptance of the Project by the Owner or until no person or entity other than the owner has an insurable interest in the covered property, whichever is earlier. This builders risk insurance shall include the interests of the Owner, Construction Manager, Contractor, Subcontractors and Sub-subcontractors in the Project.

11.4.2 - Insurance shall be on an "all-risk" or equivalent policy form and shall insure against the perils of fire, extended coverage, theft, vandalism, malicious mischief, collapse and windstorm. Coverage is to apply for debris removal including demolition occasioned by a covered loss. This insurance shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such covered loss. Coverage for other perils such as flood and earthquake or for loss caused by the enforcement of any applicable ordinance or law shall not be required unless otherwise provided in the Contract.

11.4.3 - This builders risk insurance shall cover all of the following types of property:

i. All structures to be constructed, under construction, and/or already constructed which are part of the Project;

ii. All materials, equipment, machinery and supplies which are to be incorporated into the Project;
iii. Temporary structures of any nature whatsoever; and
iv. Underground property, including but not limited to, foundations, pump stations, pumps, pipes, drains, tanks and connections.

11.4.4 - The Contractor shall be responsible for payment of any deductibles applicable under this builders risk insurance, boiler and machinery insurance or other property insurance applicable to the Project.

11.4.5 - Unless otherwise provided in the Contract Documents, this builders risk insurance shall cover materials to be incorporated into the Project which are off the site, and also such materials in transit.

11.4.6 - This builders risk insurance shall insure (or shall be amended to insure) against loss or damage caused by the boiler and machinery perils with limits and scope of coverage that are deemed by the Owner to be satisfactory. This insurance shall also include the interests of the Owner, Construction Manager, Contractor, Subcontractors and Sub-subcontractors in the Project.

11.4.7 - The Owner and Contractor waive all rights against each other and against the Architect, Owner's other Contractors and own forces described in Article 6, if any, and the subcontractors, sub-subcontractors, elected and appointed officials, officers, agents, employees and consultants of any of them, for property damage to or loss of use of the Project to the extent that such property damage or loss of use is covered by this builders risk insurance, boiler and machinery insurance or other property insurance applicable to the Project. The policies shall provide such waivers of subrogation by endorsement or otherwise.

11.4.8 - Any loss covered under this builders risk insurance, boiler and machinery insurance or other property insurance applicable to the Project shall be payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to any mortgagee clause. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

11.4.9 - The Owner, as fiduciary, shall have the power to adjust and settle a loss with insurers.

11.4.10 - Partial occupancy or use in accordance with the provisions of the Contract that pertain to partial occupancy or use shall not commence until the builders risk insurer has granted permission by endorsement or otherwise for the Owner to partially occupy or use any completed or partially completed portion of the Project at any stage of construction. The Owner and Contractor shall take reasonable steps to obtain such permission.

11.4.11 - The insurance required by this Paragraph 11.4 is not intended to cover machinery, tools or equipment owned or rented by the Contractor, or its Subcontractors, which are utilized in the performance of the Project but not incorporated into the permanent improvements. The Contractor and its Subcontractors shall, at their own expense, purchase and maintain property insurance coverage for owned, leased or rented machinery, tools or equipment. The Contractor, and its Subcontractors, hereby waive all rights against the Owner and its elected and appointed officials, officers, agents, employees and consultants for property damage to or loss of use of such

machinery, tools or equipment to the extent that such property damage or loss of use is covered by the Contractor's or Subcontractor's property or equipment floater insurance or other similar property insurance maintained by the Contractor or its Subcontractors. The policies shall provide such waivers of subrogation by endorsement or otherwise.

11.5 – Additional Insurance Requirements.

11.5.1 The Contractor shall be responsible for paying all costs not covered, including any deductibles, required by the insurer or insurers underwriting the insurance required by Paragraphs 11.2 and 11.4 and incurred for individual items and operating systems prior to the issuance of Substantial Completion (in whole or in part) or due to the Contractor's negligence or breach of contract.

11.5.2 The Contractor shall at the Contractor's own expense provide insurance coverage for materials stored off the site after written approval of the Owner at the value established in the approval, and also for portions of the Work in transit until such materials are permanently attached to the Work.

11.6 – Bonds.

Paragraph 11.6.1 The Contractor shall provide bonds in accordance with the provisions of the Pennsylvania Borough Code, 8 Pa.C.S. § 101, *et seq.*, and the Public Works Contracts' Bond Law of 1967, 8 P.S. Section 191, *et seq*., and in so doing shall provide:

(a) A performance bond at one hundred percent (100%) of the contract amount, conditioned upon the faithful performance of the Contractor in accordance with the plans, specifications and conditions of the Contract Documents. Such bond shall be solely for the protection of the Owner or assignee. The surety's liability under the bond shall be the same as the contractor's liability under the conditions of the contract. The performance bond shall be in the form of AIA Document A312 *Performance Bond* unless otherwise required by Owner.

(b) A payment bond at one hundred percent (100%) of the contract amount. Such bond shall be solely for the protection of claimants supplying labor or materials to the Contractor or to any of their Subcontractors in the prosecution of the Work provided for in the Contract Documents and shall be conditioned for the prompt payment of all such material furnished or labor supplied or performed in the prosecution of the Work. "Labor or Materials" shall include public utility services and reasonable rentals of equipment, but only for periods when the equipment rented is actually used at the site. The payment bond shall be in the form of AIA Document 312 *Payment Bond* unless otherwise required by Owner.

(c) Each of such bonds shall be executed by one or more surety companies legally authorized to do business in the Commonwealth of Pennsylvania and acceptable to the Owner. The bond shall be payable to the Owner or assignee.

Paragraph 11.6.2 Upon request of any person or entity, and the payment of a reasonable cost for copying, Owner shall provide a copy of the Payment Bond of Contractor.

ARTICLE 12, UNCOVERING AND CORRECTION OF WORK

Paragraph 12.1 **UNCOVERING WORK**. In subparagraph 12.1.1, add: "and without added cost to the Owner."

Subparagraph 12.2.2 **AFTER SUBSTANTIAL COMPLETION**. In subparagraph 12.2.2.1, delete the last two sentences of this subparagraph and add the following:
"Nothing contained in this paragraph shall decrease the liability of Contractor and/or Surety as set forth in the Performance Bond."

Subparagraph 12.2.2 **AFTER SUBSTANTIAL COMPLETION**, Add the following Clause 12.2.2.4:

12.2.2.4 Upon request by the Owner and prior to the expiration of one year from the date of Substantial Completion, the Architect will conduct and the Contractor shall attend a meeting with the Owner to review the facility operations and performance.

ARTICLE 13, MISCELLANEOUS PROVISIONS

Paragraph 13.4 **TESTS AND INSPECTIONS**. This Paragraph governs testing and inspection required by the Drawings and Specifications to be performed by Contractor. Owner will arrange for an independent testing and inspection firm to perform those tests and inspections not required to be performed by Contractor or its Subcontractor. Contractor shall perform all testing and inspections required by product manufactures to validate warranties.

Paragraph 13.4 **TESTS AND INSPECTIONS**, add the following sentence at the end of subparagraph 13.4.5:

"The Contractor shall notify the Architect at least two working days in advance when tests or inspection are required per specifications. Contractor to coordinate with owner's third party inspector"

Paragraph 13.5 **INTEREST**. At the end of Paragraph 13.5, add the following:

"Progress payments due Contractor under the Contract Documents shall bear interest from the date payment is due at the rate of 3% annum, simple interest. For final payments, the parties acknowledge that the Project and Work under the Contract Documents will occur and be constructed with the proceeds of a bond issue. Final payment due Contractor under the Contract Documents shall bear interest from the date payment is due at the rate of interest of the bond issue or at the rate of 10% per annum, simple interest, whichever is less, but in no event shall the interest payable to the Contractor be at a rate of interest less than the legal rate of interest."

Add new Paragraph 13.8 **CODE COMPLIANCE** as follows:

13.8 CODE COMPLIANCE

13.8.1 Fire Rated Assemblies: All penetrations and openings whether indicated or not through fire-rated walls, floor/ceiling or roof/ceiling assemblies which are indicated on the drawings, shall be provided and installed to maintain the fire-rated integrity of the design with dampers, tenting over lights, etc. These penetrations and openings include, but shall not be limited to, louvers, lights, mechanical and electrical penetrations, etc."

13.8.2 Fire Rated Partitions: All fire partitions shall extend from the top of the floor assembly below to the underside of the floor/roof slab or deck above, to the fire resistance rated floor/ceiling or roof/ceiling assembly above, and shall be securely attached thereto.

Add new Paragraph 13.9 **SWORN STATEMENT/RELEASE OF LIENS** as follows:

13.9 SWORN STATEMENT/RELEASE OF LIENS

13.9.1 Contractor agrees that the Project is not subject to the Mechanics Lien Law. To assure Owner that Contractor has made full payment of all sums due under the subcontract, Contractor shall submit with its final Application for Payment a Sworn Statement/Release of Liens stating that the signer (the Contractor or Subcontractor) has paid all Subcontractors, suppliers and laborers who have performed Work on the project in the full amount due.

Add new Paragraph 13.10 **DISCRIMINATION PROHIBITED** as follows:

13.10 DISCRIMINATION PROHIBITED

13.10.1 In accordance to Section 62 Pa.C.S.A. § 3701, the Contractor agrees that:

13.10.1.1 In the hiring of employees for the performance of work under this Contract, or any sub-contract, no contractor, subcontractor, or any person acting on behalf of the contractor or subcontractor shall, by reason of gender, race, creed or color, discriminate against any citizen of this Commonwealth who is qualified and available to perform the work to which the employment relates.

13.10.1.2 No contractor, sub-contractor, or any person acting on their behalf, shall in any manner discriminate against or intimidate any employee hired for the performance of work under this Contract on account of gender, race, creed or color.

13.10.1.3 The Contract may be canceled or terminated by the government agency, and all money due or to become due under the Contract may be forfeited, for violation of the terms or conditions of that portion of the Contract.

Add new Paragraph 13.11 **HUMAN RELATIONS ACT** as follows:

13.11 HUMAN RELATIONS ACT

13.11.1 The provisions of the Pennsylvania Human Relations Act, Act 222 of October 27, 1955 (Amended P.L. 744) (43 P.S. § 951, et seq.) of the Commonwealth of Pennsylvania prohibit discrimination because of race, color, familial status religious creed, ancestry, age, sex, national origin, handicap or disability by employers, employment agencies, labor organizations, contractors and others. The Contractor shall agree to comply with the provisions of this Act as amended, which are hereby made part of this specification. Your attention is directed to the language of the Commonwealth's non-discrimination clause in 16 PA. Code 49.101. The Contractor shall also agree to comply with any applicable provisions of the Conshohocken Human Relations Ordinance.

Add new Paragraph 13.12 **COMPETENT WORKMEN** as follows:

13.12 COMPETENT WORKMEN

13.12 Neither the Contractor nor any Subcontractor or sub-subcontractor shall employ any person to perform work under this Contract who is not competent and properly skilled in the work assigned. The Contractor shall be responsible for ensuring that all work is performed by qualified personnel in accordance with the Contract Documents and applicable codes and regulations. The Contractor and all Subcontractors shall comply with applicable federal, state, and local wage requirements, including the Pennsylvania Prevailing Wage Act where applicable.

Add new Paragraph 13.13 **STANDARD OF QUALITY**

13.13 STANDARD OF QUALITY

13.13.1 The various materials and products specified in the specifications by name or description are given to establish a minimum acceptable standard of quality and of cost for bid purposes. It is not the intent to limit Bidder, the Bid or the evaluation of the Bid to any one material or product specified, but rather to describe the minimum standard. When proprietary names are used, they shall be followed by the words "or alternatives of the quality necessary to meet the specifications". A Bid containing an alternative, which does not meet the specifications, may be declared non-responsive. A Bid containing an alternative may be accepted, but if an award is made to that Bidder, the Bidder will be required to replace any alternatives, which do not meet the specifications. (Refer to Article 9 of the Instructions to Bidder)When proprietary names are used, and there does not follow a "listing" of acceptable approved manufacturers and/or products, then the proprietary named item must be included in the bid proposal without substitution. When proprietary names are used, and there follows a "listing" of acceptable "approved" manufacturers and/or products, then the contractor may base the bid on either the proprietary product or any from the "listing". Bidders may request approval prior to bid opening of non-listed items in accordance with the specifications. When proprietary names are used, and there are alternates for the specified item on the bid form, then the contractor shall base his bid on the proprietary product or any from the "listing" of approved manufacturers and/or products. The bidder must furnish the specified or listed item or accepted alternate, regardless of whether or not they were included in his bid. The bidder shall be required to coordinate and pay for any conditions which are required to accommodate the listed or alternate item, including the reimbursement of other affected prime contractors.

Add new Paragraph 13.14 **PROVISION FOR THE USE OF STEEL AND STEEL PRODUCTS MADE IN THE U.S.** as follows:

13.14 PROVISION FOR THE USE OF STEEL AND STEEL PRODUCTS MADE IN THE U.S.

13.14.1 In accordance with the Act of March 3, 1978 (P.L. 6, No. 3), as amended, known as the Steel Products Procurement Act (73 P.S. § 1881 et seq.), all steel products used or supplied in the performance of the Contract or any subcontracts thereunder shall comply with the requirements of the Act. Steel products shall be produced in the United States as defined therein, except as otherwise permitted by the Act.

13.14.2 In accordance with Act 161 of 1982, cast iron products shall also be included within the definition of steel products and shall comply with the requirements of the Act.
Act 144 of 1984 further amended the definition of "steel products" to include specified machinery and equipment classified under Standard Industrial Classification (SIC) Codes 25, 35, and 37, when made of, fabricated from, or containing steel components. The Act also establishes applicable compliance requirements, exceptions, and penalties for violations.

Add new Paragraph 13.15 **CASH ALLOWANCES**

13.15 NO CASH ALLOWANCES

13.15.1 NO CASH ALLOWANCES: Cash allowances are not to be included in the bid specifications.

Add new Paragraph 13.16 **RIGHT TO KNOW ACT** as follows:

13.16 RIGHT TO KNOW ACT

13.16.1 Contractor shall comply with all terms and conditions of the Pennsylvania Right to Know Act, Act No. No. 3 of 2008 as amended, 65 P.S. § 67.101 et. seq, and its implementing regulations, which are applicable to records maintained by a contractor of a public agency.

Add new Paragraph 13.17 **IDENTIFICATION**

13.17 IDENTIFICATION

13.17.1 The Owner reserves the right to require all construction employees to be visually identified by the use of badges. In the event this security measure is implemented, the Owner will issue badges to all authorized employees in conjunction with the prime Contractors and record their issuance with names, addresses, etc. Termination of employment of the construction employees will require the respective badges to be returned to the Owner for record keeping purposes. All employees must wear the badge on the job site. Employees without badges will not be permitted on the premises.

Add new Paragraph 13.18 **ACT 34 CRIMINAL BACKGROUND CHECKS** as follows:

13.18 ACT 34 CRIMINAL BACKGROUND CHECKS

13.18.1 Prior to commencing work at the Project site, the Contractor shall obtain criminal history background checks for its employees and the employees of all Subcontractors who will perform work at the Project site. Background checks shall be conducted through the Pennsylvania State Police or the appropriate criminal history record-checking agency for individuals residing outside the Commonwealth of Pennsylvania. The Contractor shall maintain documentation confirming completion of the required background checks and shall provide such documentation to the Owner upon request. The Contractor shall not permit any individual to perform work at the Project site until the required background check has been completed. The Contractor shall ensure compliance with all applicable federal, state, and local laws governing criminal history information.

Add new Paragraph 13.19 **CHILD PROTECTIVE SERVICES BACKGROUND CHECKS** as follows:

13.19 CHILD PROTECTIVE SERVICES BACKGROUND CHECKS

13.19.1 The Contractor shall ensure that its employees, Subcontractors, and their employees obtain all criminal history and child abuse clearances required by applicable federal and Pennsylvania law for the

work performed under this Contract. Where such clearances are legally required, the Contractor shall verify completion prior to permitting the individual to perform the applicable work and shall provide evidence of compliance to the Owner upon request.

Add new Paragraph 13.20 **NO BLASTING IS PERMITTED** as follows:

13.20 NO BLASTING IS PERMITTED

13.20.1 The Contractor shall perform all storage, handling and use of explosives for the purpose of excavation in strict accordance with Title 25, Chapter 211, of the Pennsylvania Code, as well as any applicable local regulations. Strict control of blasting must be maintained to prevent fly rock, and blasting mats must be used where conditions dictate their use. When blasting within 25 feet of utility lines, such blasting must be performed according to Section 211.52 of Title 25 of the Pennsylvania Code.

Add new Paragraph 13.21 **SITE EXCAVATION** as follows:

13.21 SITE EXCAVATION

13.21.1 Contractor agrees that, not less than three (3) working days prior to beginning excavation or demolition work as defined in the Pennsylvania Underground Utility Line Protection Law, Act 287 of 1974, as amended, 73 P.S. § 176 et seq, he shall request the information required by Section 5 of the Act and shall inform each operator employed at the site of the Work of the information received with respect to location of underground installations. Contractor shall agree to report immediately to the user of the underground installations and to the Owner and Architect, any break in its lines, or dent, gouge, groove or other damage to such lines, their coating or cathodic protection, made or discovered in the course of the excavation or demolition work. Contractor shall comply with all other provisions of the Act, as amended.

Add new Paragraph 13.22 **WAIVER OF CONSEQUENTIAL** DAMAGES as follows:

13.22 WAIVER OF CONSEQUENTIAL DAMAGES

13.22.1 Contractor waives claims against Owner for consequential damages arising out of or relating to this Contract, including, but not limited to, damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

Add new Paragraph 13.23 **ALL APPLICABLE LAWS, STATUTES, REGULATIONS AND STANDARDS** as follows:

13.23 ALL APPLICABLE LAWS, STATUTES, REGULATIONS AND STANDARDS

13.23.1 Contract shall comply with all applicable federal, state, local and industry statutes, regulations, ordinances, codes and standards. The failure to specifically reference or include said matters in the Contract Documents does not excuse Contractor from compliance with same. If any provision of the Contract Documents irreconcilably conflicts with a mandatory provision of applicable federate, state,

local, and industry statutes, regulations, ordinances, codes, and standards, such mandatory provision shall control.

Add new Paragraph 13.24 **THE IMPLEMENTING REGULATIONS OF THE PENNSYLVANIA PREVAILING WAGE** ACT (ACT 422 of 1961, P.L. 987. AMENDED), as follows:

13.24 THE IMPLEMENTING REGULATIONS OF THE PENNSYLVANIA PREVAILING WAGE ACT (ACT 422 of 1961, P.L. 987. AMENDED)

13.24.1 Pennsylvania Prevailing Wage Rates: This regulation and the general Pennsylvania prevailing minimum wage rates as determined by the Secretary of Labor and Industry, which shall be paid for each craft or classification of all workers needed to perform the Contract during the anticipated term therefore in the locality in which public work is performed, are made part of this specification. (Reference Section 00830)

ARTICLE 14, TERMINATION OR SUSPENSION OF THE CONTRACT

Delete Paragraph 14.1 **TERMINATION BY THE CONTRACTOR** in its entirety.

Paragraph 14.2 **TERMINATION BY THE OWNER FOR CAUSE**, delete subparagraph 14.2.1 in its entirety and replace with the following:

14.2.1 The Owner may terminate the Contract if the contractor

a. institutes proceedings or consent to proceedings requesting relief or arrangement under the Federal Bankruptcy Code or any similar or applicable federal or state law; or if a petition under any federal or state bankruptcy or insolvency law is filed against the Contractor and such petition is not dismissed within sixty (60) days from the date of said filing; or if the Contractor admits in writing its inability to pay its debts generally as they become due, or if it makes a general assignment for the benefit of its creditors, or if a receiver, liquidator, trustee or assignee is appointed on account of its bankruptcy or insolvency; or if a receiver of all or any substantial portion of the Contractor's properties is appointed.

b. abandons the Work; or if it fails, except in cases for which extension of time is provided, to prosecute promptly and diligently the Work or to supply enough properly skilled workmen or proper materials for the Work;

c. submits an Application for Payment, sworn statement, waiver of lien, affidavit or document of any nature whatsoever which is intentionally falsified;

d. fails to make prompt payment to Subcontractors or for materials or labor or otherwise breaches their obligations under any subcontract with a Subcontractor; of if a mechanic's or materialman's lien or notice of lien is filed against any party of the Work or the site of the Project and not promptly bonded or insured over by the Contractor in a manner satisfactory to the Owner;

e. disregards any laws, statutes, ordinances, rules, regulations or orders of any governmental body or public or quasi-public authority having jurisdiction of the Work or the site of the Project;

f. otherwise violates any provision of the Contract Documents;

g. then the Owner, upon the occurrence of the events described in clauses .a through .f above, without prejudice to any right or remedy available to the Owner under the Contract Documents or at law or in equity may, after giving the Contractor and the surety under the Performance Bond and under the Labor and Material Payment Bond, if any, seven (7) days written notice, terminate the employment of the Contractor and, in accordance with the Uniform Commercial Code, may enforce a Security Agreement by taking possession of and using all or any part of Contractor's materials, equipment, supplies and other property of every kind used by the Contractor in the performance of the Work in the completion of the Work. If requested by Owner, the Contractor shall remove any part or all of its equipment, machinery and supplies from the site of the Project within seven (7) days from the date of such request, and in the event of the Contractor's failure to do so, the Owner shall have the right to remove or store such equipment, machinery and supplies at the Contractor's expense. In case of such termination, the Contractor shall not be entitled to receive any further payment for Work performed by the contract through the date of termination. The Owner's right to terminate the Owner-Contractor Agreement pursuant to this Subparagraph 14.2.1 shall be in addition to and not in limitation of any rights or remedies existing hereunder or pursuant hereto or at law or in equity.

Paragraph 14.2 **TERMINATION BY THE OWNER FOR CAUSE**, in subparagraph 14.2.2, delete the last sentence.

Paragraph 14.2 **TERMINATION BY THE OWNER FOR CAUSE**, delete subparagraph 14.2.4 and replace with the following:

14.2.4 If the unpaid balance of the Contract Sum exceeds all costs to the Owner of completing the Work, then the Contractor shall be paid for all Work performed by the Contractor to the date of termination, as determined accurate by Architect. If such costs to the Owner of completing the Work exceed such unpaid balance, the Contractor shall pay the difference to the Owner immediately upon Owner's demand. The costs to the Owner of completing the Work shall include (but not be limited to) the cost of any additional architectural, managerial and administrative services required thereby, any costs incurred in retaining another contractor or other subcontractors, any additional interest or fees which the Owner must pay by reason of a delay in completion of the Work, attorneys' fees and expense, and any other damage, costs and expenses the Owner may incur by reason of completing the Work of any delay thereof. The amount, if any, to be paid to the Contractor shall be certified by the Architect upon application, in the manner provided in Paragraph 9.4, and this obligation for payment shall survive the termination of the Contract.

Paragraph 14.2 **TERMINATION BY THE OWNER FOR CAUSE**, add new subparagraph 14.2.5 as follows:

14.2.5 In the event the Owner terminates the contract for cause, and such cause is determined to be valid and justified, in addition and without prejudice to all other rights, remedies and relief which the Owner may obtain under this Agreement and pursuant to the law, the Owner shall be entitled to payment by Contractor of all reasonable professional fees, including attorney's fees, architectural fees, engineering fees, and consulting fees (together with reasonable expenses and disbursements incurred in connection therewith) which the Owner may incur in connection with any legal proceedings or action (including professional fees rendered in anticipation of such proceedings or action). This provision shall create no right to the Contractor or to any other person or entity for payment of such costs or expenses.

Paragraph 14.4 **TERMINATION BY THE OWNER FOR CONVENIENCE**, delete 14.4.3 and replace with the following:

14.4.3 In case of such termination for the Owner's convenience, the contractor shall be entitled to receive payment from the Owner only for Work completed, using the schedule of values provided by Contractor and used in making periodic payments.

ARTICLE 15, CLAIMS AND DISPUTES

Paragraph 15.1.2 TIME LIMITS ON CLAIMS delete in its entirety.

Paragraph 15.1.6 CLAIMS **FOR ADDITIONAL TIME**, delete 15.1.6.2 and replace with the following:

15.1.6.2 No Claim for an Extension of Time will be granted for adverse weather. Contract completion date are as indicated in the contract documents.

END OF DOCUMENT

SECTION 00.7343 – PENNSYLVANIA PREVAILING WAGE RATE REQUIREMENTS

PART 1 - GENERAL

1.1 Prevailing Wage Rates: Prevailing Wage Rates and notes are attached to the end of this section.

1.2 Prevailing Wage Rates

1. The general provisions of the Pennsylvania Prevailing Wage Act, approved August 15, 1961, as amended are applicable to this project.

2. The general prevailing minimum wage rates including contributions for employee benefits as shall have been determined by the Secretary of Labor and Industry (hereinafter "Secretary"), which must be paid to the workmen, employed in the performance of the Contract.

3. The Contractor shall pay no less than the wage rates as determined in the decision of the Secretary and shall comply with the conditions of the Pennsylvania Prevailing Wage Act, Act 442 of 1961, as amended 43 § 165-1 et seq, and the Regulations issued pursuant thereto, to assure the full and proper payment of said rates.

4. These Contract provisions shall apply to all work performed on the Contract by the Contractor and to all work performed on the contract by all subcontractors.

5. The Contractor shall insert in each of his subcontracts all of the stipulations contained in these required provisions.

6. No workmen may be employed on the Work except in accordance with the classifications set forth in the decision of the Secretary. In the event that additional or different classifications are necessary the procedure set forth in the Regulations shall be followed.

7. All workmen employed or working on the Work shall be paid unconditionally, regardless of whether any contractual relationship exists or the contractual relationship which may be alleged to exist between any contractor, subcontractor and workmen, not less than once a week without deductions or rebate, on any account, either directly or indirectly, except authorized deductions, the full amount due at the time of payment, computed at the rates applicable to the time worked in the appropriate classification. Nothing in this Contract, the Act or the Regulations shall prohibit the payment of more than the general prevailing minimum wage rates as determined by the Secretary to the workmen on the Work.

8. The Contractor and each subcontractor shall post for the entire period of construction the wage determination decisions of the Secretary, including the effective date of any changes thereof, in a prominent and easily accessible place or places at the site of the work and at such place or places used by them to pay workmen their wages. The posted notice of wage rates must contain the following information:
    a. Name of project.
    b. Name of public body of which it is constructed.

c. The crafts and classifications of workmen listed in the Secretary's general prevailing minimum wage rate determination for the particular project.

d. The general prevailing minimum wage rates determined for each craft and classification and the effective date of any changes.

e. A statement advising workmen that if they have been paid less than the general prevailing minimum wage rate for their job classification or that the Contractor and/or subcontractor are not complying with the Act or the Regulations in any manner whatsoever, they may file a protest with the Secretary within three (3) months of the date of the occurrence, objecting to the payment to the Contractor to the extent of the amount or amounts due or to become due to them as wages for work performed on the Project. Any workmen paid less than the rate specified in the Contract shall have a civil right of action for the difference between the wage paid and wages stipulated in the Contract, which right of action must be exercised within six (6) months from the occurrence of the event creating such right.

9. The Contractor and all subcontractors, shall keep an accurate record showing the name, craft and/or classification, number of hours worked per day, and the actual hourly rate of wage paid (including employee benefits) to each workman employed by him in connection with the Work and such record must include any deductions from each workman. The record shall be preserved for two (2) years from the date of payment and shall open at all reasonable hours to the inspection of the Owner and to the Secretary or his duly authorized representative.

10. Apprentices shall be limited to such numbers as shall be in accordance with a bona fide apprenticeship program registered with and approved by the Pennsylvania Apprenticeship and Training Council and only apprentices whose training and employment are in full compliance with the provisions of the Apprenticeship and Training Act approved July 14, 1961 (Act No. 304) and the Rules and Regulation issued pursuant thereto shall be employed on the Work. Any workmen using the tools of a craft that does not qualify as an apprentice within the provisions of this submission shall be paid the rate predetermined for journeyman in that particular craft and/or classification.

11. Wages shall be paid without any deductions except authorized deductions. Employers not party to a contract requiring contributions for employee benefits which the Secretary has determined to be included in the general prevailing minimum wage rate shall pay the monetary equivalent thereof directly to the workman.

12. Payment of compensation to workmen for work performed on public work on a lump sum basis, or apiece work system, or a price certain for the completion of a certain amount of work, or the production of a certain result shall be deemed a violation of the Act and the Regulations, regardless of the average hourly earnings resulting therefrom.

13. Each Contractor and each subcontractor shall file a statement each week and a final statement at the conclusion of the Work on the Contract with Owner, under oath, and in form satisfactory to the Secretary, certifying that all workmen have been paid wages in strict conformity with the provisions of the Contract as prescribed by the Regulations, or if any wages remain unpaid, to the amount of wages due and owing to each workman respectively.

14. The provision of the Act and the Regulations are incorporated by reference in the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 00.7343

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project Name:	Bourough of Conshohocken - Public Safety Facility
General Description:	New 30,000 square foot public safety facility consisting of fire station, EMS and community center. The project will be bid as multiple prime with General, Electrical, Plumbing, Mechanical, and Traffic Signal Modernization.
Project Locality	Borough of Conshohocken
Awarding Agency:	Borough of Conshohocken
Contract Award Date:	1/6/2027
Serial Number:	26-09149
Project Classification:	Building/Highway
Determination Date:	10/16/2026
Assigned Field Office:	Philadelphia
Field Office Phone Number:	(215)560-1858
Toll Free Phone Number:	
Project County:	Montgomery County

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 26-09149 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Asbestos & Insulation Workers	5/1/2025		$60.84	$48.71	$109.55
Asbestos & Insulation Workers	5/1/2026		$64.51	$50.26	$114.77
Boilermaker (Commercial, Institutional, and Minor Repair Work)	3/1/2024		$36.71	$19.13	$55.84
Boilermaker (Commercial, Institutional, and Minor Repair Work)	3/1/2026		$41.34	$19.23	$60.57
Boilermakers	1/1/2024		$52.10	$35.72	$87.82
Boilermakers	1/1/2026		$58.00	$36.57	$94.57
Bricklayer	5/1/2025		$50.00	$32.57	$82.57
Bricklayer	5/1/2026		$51.15	$34.92	$86.07
Carpenter - Chief of Party (Surveying & Layout)	5/1/2026		$55.83	$30.39	$86.22
Carpenter - Chief of Party (Surveying & Layout)	5/1/2027		$58.03	$30.74	$88.77
Carpenter - Chief of Party (Surveying & Layout)	5/1/2028		$60.29	$31.09	$91.38
Carpenter - Chief of Party (Surveying & Layout)	5/1/2029		$62.63	$31.44	$94.07
Carpenter - Instrument Person (Surveying & Layout)	5/1/2026		$48.55	$30.39	$78.94
Carpenter - Instrument Person (Surveying & Layout)	5/1/2027		$50.46	$30.74	$81.20
Carpenter - Instrument Person (Surveying & Layout)	5/1/2028		$52.43	$31.09	$83.52
Carpenter - Instrument Person (Surveying & Layout)	5/1/2029		$54.46	$31.44	$85.90
Carpenter - Instrument Person (Surveying & Layout)	5/1/2030		$56.55	$31.79	$88.34
Carpenter - Rodman (Surveying & Layout)	5/1/2026		$24.28	$21.99	$46.27
Carpenter - Rodman (Surveying & Layout)	5/1/2027		$25.23	$22.34	$47.57
Carpenter - Rodman (Surveying & Layout)	5/1/2028		$26.22	$22.69	$48.91
Carpenter - Rodman (Surveying & Layout)	5/1/2029		$27.23	$23.04	$50.27
Carpenter - Rodman (Surveying & Layout)	5/1/2030		$28.28	$23.39	$51.67
Carpenters	5/1/2026		$48.55	$30.39	$78.94
Carpenters	5/1/2027		$50.46	$30.74	$81.20
Carpenters	5/1/2028		$52.43	$31.09	$83.52
Carpenters	5/1/2029		$54.46	$31.44	$85.90
Carpenters	5/1/2030		$56.55	$31.79	$88.34
Cement Finishers & Plasterers	5/1/2022		$38.57	$32.39	$70.96
Cement Masons	5/1/2024		$46.70	$32.46	$79.16
Cement Masons	5/1/2025		$48.70	$32.46	$81.16
Dockbuilder, Pile Drivers	5/1/2026		$56.98	$37.99	$94.97
Dockbuilder/Pile Driver Diver	5/1/2026		$66.54	$41.74	$108.28
Dockbuilder/pile driver tender	5/1/2026		$56.98	$37.99	$94.97
Drywall Finisher	5/1/2025		$40.14	$32.35	$72.49
Drywall Finisher	5/1/2026		$41.10	$32.99	$74.09
Electricians	5/1/2025		$70.97	$47.27	$118.24
Electricians	5/4/2026		$75.05	$48.19	$123.24
Electricians	5/3/2027		$78.33	$51.16	$129.49
Electricians	5/1/2028		$81.99	$54.00	$135.99
Elevator Constructor	1/1/2025		$71.85	$45.77	$117.62
Elevator Constructor	1/1/2026		$74.86	$46.86	$121.72
Floor Coverer	5/1/2025		$51.67	$31.69	$83.36
Floor Coverer	5/1/2026		$52.84	$32.86	$85.70

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 26-09149 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Glazier	5/1/2025		$49.96	$38.34	$88.30
Glazier	5/1/2026		$51.30	$39.37	$90.67
Interior Finish	5/1/2023		$34.60	$25.80	$60.40
Iron Workers (Bridge, Structural, Ornamental, Precast)	7/1/2024		$53.20	$45.01	$98.21
Iron Workers (Riggers)	7/1/2025		$44.77	$36.27	$81.04
Iron Workers (Riggers)	7/1/2026		$48.84	$36.52	$85.36
Iron Workers (Rodman/Reinforcing)	7/1/2025		$47.80	$36.65	$84.45
Iron Workers (Rodman/Reinforcing)	7/1/2026		$52.39	$36.90	$89.29
Laborers (Class 01 - See notes)	5/1/2025		$37.25	$26.10	$63.35
Laborers (Class 02 - See notes)	5/1/2025		$41.00	$27.70	$68.70
Laborers (Class 03 - See notes)	5/1/2025		$37.67	$26.28	$63.95
Laborers (Class 04 - See notes)	5/1/2025		$37.67	$26.28	$63.95
Laborers (Class 05 - See notes)	5/1/2025		$37.25	$26.10	$63.35
Landscape Laborer	5/1/2024		$30.70	$24.23	$54.93
Landscape Laborer	5/1/2025		$32.15	$24.30	$56.45
Marble Finisher	5/1/2025		$41.17	$30.75	$71.92
Marble Finisher	5/1/2026		$42.07	$31.85	$73.92
Marble Mason	5/1/2023		$47.20	$31.95	$79.15
Marble Setter	5/1/2026		$51.50	$33.80	$85.30
Mason Tender, Cement	5/1/2023		$35.02	$25.98	$61.00
Millwright	5/1/2025		$57.39	$35.81	$93.20
Millwright	5/1/2026		$60.20	$35.81	$96.01
Operators (Building, Class 01 - See Notes)	5/1/2025		$54.52	$34.49	$89.01
Operators (Building, Class 01 - See Notes)	5/1/2026		$55.67	$35.34	$91.01
Operators (Building, Class 01A - See Notes)	5/1/2025		$57.52	$35.38	$92.90
Operators (Building, Class 01A - See Notes)	5/1/2026		$58.68	$36.22	$94.90
Operators (Building, Class 02 - See Notes)	5/1/2025		$54.27	$34.42	$88.69
Operators (Building, Class 02 - See Notes)	5/1/2026		$55.43	$35.26	$90.69
Operators (Building, Class 02A - See Notes)	5/1/2025		$57.29	$35.29	$92.58
Operators (Building, Class 02A - See Notes)	5/1/2026		$58.44	$36.14	$94.58
Operators (Building, Class 03 - See Notes)	5/1/2025		$50.18	$33.22	$83.40
Operators (Building, Class 03 - See Notes)	5/1/2026		$51.34	$34.06	$85.40
Operators (Building, Class 04 - See Notes)	5/1/2025		$49.88	$33.13	$83.01
Operators (Building, Class 04 - See Notes)	5/1/2026		$51.04	$33.97	$85.01
Operators (Building, Class 05 - See Notes)	5/1/2025		$48.16	$32.62	$80.78
Operators (Building, Class 05 - See Notes)	5/1/2026		$49.32	$33.46	$82.78
Operators (Building, Class 06 - See Notes)	5/1/2025		$47.17	$32.33	$79.50
Operators (Building, Class 06 - See Notes)	5/1/2026		$48.34	$33.16	$81.50
Operators (Building, Class 07A- See Notes)	5/1/2025		$66.26	$39.55	$105.81
Operators (Building, Class 07A- See Notes)	5/1/2026		$67.73	$40.48	$108.21
Operators (Building, Class 07B- See Notes)	5/1/2025		$65.97	$39.46	$105.43
Operators (Building, Class 07B- See Notes)	5/1/2026		$67.44	$40.39	$107.83
Painters Class 1 (see notes)	5/1/2025		$44.38	$34.55	$78.93
Painters Class 1 (see notes)	5/1/2026		$45.71	$35.22	$80.93

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 26-09149 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Painters - Line Stripping	12/1/2025		$45.12	$29.41	$74.53
Painters Class 4 (see notes)	5/1/2025		$46.47	$34.55	$81.02
Painters Class 4 (see notes)	5/1/2026		$48.45	$35.22	$83.67
Plasterers	5/1/2024		$39.88	$33.08	$72.96
plumber	5/1/2025		$70.53	$39.46	$109.99
plumber	5/1/2026		$73.73	$40.36	$114.09
Pointers, Caulkers, Cleaners	5/1/2025		$51.35	$31.80	$83.15
Pointers, Caulkers, Cleaners	5/1/2026		$53.35	$32.30	$85.65
Roofers (Composition)	5/1/2025		$46.03	$34.77	$80.80
Roofers (Composition)	5/1/2026		$47.53	$35.22	$82.75
Roofers (Shingle)	5/1/2023		$32.85	$22.10	$54.95
Roofers (Shingle)	5/1/2024		$34.35	$22.20	$56.55
Roofers (Slate & Tile)	5/1/2023		$35.85	$22.10	$57.95
Roofers (Slate & Tile)	5/1/2024		$37.35	$22.20	$59.55
Sheet Metal Workers	5/1/2025		$62.62	$52.17	$114.79
Sheet Metal Workers	5/1/2026		$65.06	$54.48	$119.54
Sign Makers and Hangars	7/15/2025		$33.48	$26.41	$59.89
Sign Makers and Hangars	7/15/2026		$36.38	$25.01	$61.39
Sprinklerfitters	1/1/2023		$62.23	$31.99	$94.22
Sprinklerfitters	5/1/2025		$70.37	$34.85	$105.22
Steamfitters	5/1/2024		$70.32	$43.09	$113.41
Steamfitters	5/1/2025		$72.52	$44.89	$117.41
Stone Masons	5/1/2025		$50.00	$32.80	$82.80
Stone Masons	5/1/2026		$51.50	$33.80	$85.30
Terrazzo Finisher	5/1/2025		$45.61	$29.41	$75.02
Terrazzo Finisher	5/1/2026		$47.78	$29.61	$77.39
Terrazzo Grinder	5/1/2025		$45.88	$29.41	$75.29
Terrazzo Grinder	5/1/2026		$47.78	$29.61	$77.39
Terrazzo Mechanics	5/1/2025		$52.21	$31.26	$83.47
Terrazzo Mechanics	5/1/2026		$53.36	$32.61	$85.97
Tile Finisher	5/1/2025		$41.17	$30.75	$71.92
Tile Finisher	5/1/2026		$42.07	$31.85	$73.92
Tile Setter	5/1/2025		$52.21	$31.26	$83.47
Tile Setter	5/1/2026		$53.36	$32.61	$85.97
Truckdriver class 1(see notes)	5/1/2024		$36.79	$22.54	$59.33
Truckdriver class 1(see notes)	5/1/2026		$38.57	$23.87	$62.44
Truckdriver class 2 (see notes)	5/1/2024		$36.89	$22.54	$59.43
Truckdriver class 2 (see notes)	5/1/2026		$38.67	$23.87	$62.54
Truckdriver class 3 (see notes)	5/1/2026		$38.92	$23.87	$62.79
Window Film / Tint Installer	6/1/2025		$27.42	$15.13	$42.55
Window Film / Tint Installer	6/1/2026		$28.35	$15.60	$43.95

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 26-09149 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Bricklayer	5/1/2025		$50.00	$32.57	$82.57
Bricklayer	5/1/2026		$51.15	$34.92	$86.07
Carpenter - Chief of Party (Surveying & Layout)	5/1/2025		$65.96	$30.09	$96.05
Carpenter - Chief of Party (Surveying & Layout)	5/1/2026		$67.52	$30.44	$97.96
Carpenter - Instrument Person (Surveying & Layout)	5/1/2025		$58.39	$29.06	$87.45
Carpenter - Instrument Person (Surveying & Layout)	5/1/2026		$60.09	$29.06	$89.15
Carpenter - Rodman (Surveying & Layout)	5/1/2025		$45.88	$23.19	$69.07
Carpenter - Rodman (Surveying & Layout)	5/1/2026		$46.97	$23.54	$70.51
Carpenter	5/1/2025		$57.36	$30.09	$87.45
Carpenter	5/1/2026		$58.71	$30.44	$89.15
Cement Masons	5/1/2023		$43.20	$32.91	$76.11
Cement Masons	5/1/2025		$46.55	$32.66	$79.21
Dockbuilder, Pile Drivers	5/1/2025		$55.23	$37.99	$93.22
Dockbuilder, Pile Drivers	5/1/2026		$56.98	$37.99	$94.97
Dockbuilder/ Pile driver diver	5/1/2025		$60.31	$44.97	$105.28
Dockbuilder/ Pile driver diver	5/1/2026		$61.88	$45.47	$107.35
Dockbuilder/Pile Driver Diver	5/1/2025		$64.35	$41.74	$106.09
Dockbuilder/Pile Driver Diver	5/1/2026		$66.54	$41.74	$108.28
Dockbuilder/pile driver tender	5/1/2025		$55.23	$37.99	$93.22
Dockbuilder/pile driver tender	5/1/2026		$56.98	$37.99	$94.97
Electric Lineman	6/3/2024		$62.07	$33.96	$96.03
Electric Lineman	6/2/2025		$65.10	$34.45	$99.55
Iron Workers (Bridge, Structural, Ornamental, Precast)	7/1/2024		$53.20	$45.01	$98.21
Iron Workers (Riggers)	7/1/2023		$42.53	$34.14	$76.67
Iron Workers (Rodman/Reinforcing)	7/1/2023		$45.70	$34.77	$80.47
Laborers (Class 01 - See notes)	5/1/2025		$40.20	$27.80	$68.00
Laborers (Class 01 - See notes)	5/1/2026		$41.65	$27.90	$69.55
Laborers (Class 02 - See notes)	5/1/2025		$40.40	$27.80	$68.20
Laborers (Class 02 - See notes)	5/1/2026		$41.85	$27.90	$69.75
Laborers (Class 03 - See notes)	5/1/2025		$40.40	$27.80	$68.20
Laborers (Class 03 - See notes)	5/1/2026		$41.85	$27.90	$69.75
Laborers (Class 04 - See notes)	5/1/2025		$35.00	$27.80	$62.80
Laborers (Class 04 - See notes)	5/1/2026		$36.45	$27.90	$64.35
Laborers (Class 05 - See notes)	5/1/2025		$41.05	$27.80	$68.85
Laborers (Class 05 - See notes)	5/1/2026		$42.50	$27.90	$70.40
Laborers (Class 06 - See notes)	5/1/2025		$41.10	$27.80	$68.90
Laborers (Class 06 - See notes)	5/1/2026		$42.55	$27.90	$70.45
Laborers (Class 07 - See notes)	5/1/2025		$40.95	$27.80	$68.75
Laborers (Class 07 - See notes)	5/1/2026		$42.40	$27.90	$70.30
Laborers (Class 08 - See notes)	5/1/2025		$40.70	$27.80	$68.50
Laborers (Class 08 - See notes)	5/1/2026		$42.15	$27.90	$70.05
Laborers (Class 09 - See notes)	5/1/2025		$40.55	$27.80	$68.35
Laborers (Class 09 - See notes)	5/1/2026		$42.00	$27.90	$69.90
Laborers (Class 10- See notes)	5/1/2025		$40.70	$27.80	$68.50

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 26-09149 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Laborers (Class 10- See notes)	5/1/2026		$42.15	$27.90	$70.05
Laborers (Class 11 -See Notes)	5/1/2025		$40.60	$27.80	$68.40
Laborers (Class 11 -See Notes)	5/1/2026		$42.05	$27.90	$69.95
Laborers (Class 12 -See Notes)	5/1/2025		$42.30	$27.80	$70.10
Laborers (Class 12 -See Notes)	5/1/2026		$42.85	$27.90	$70.75
Laborers (Class 13 -See Notes)	5/1/2025		$44.33	$27.80	$72.13
Laborers (Class 13 -See Notes)	5/1/2026		$45.78	$27.90	$73.68
Laborers (Class 14 -See Notes)	5/1/2025		$40.90	$27.80	$68.70
Laborers (Class 14 -See Notes)	5/1/2026		$41.90	$27.90	$69.80
Laborers Utility (PGW ONLY) (Flagperson)	5/1/2025		$34.07	$19.73	$53.80
Laborers Utility (PGW ONLY) (Flagperson)	5/1/2026		$35.52	$19.83	$55.35
Laborers Utility (PGW ONLY)	5/1/2025		$41.10	$19.73	$60.83
Laborers Utility (PGW ONLY)	5/1/2026		$42.55	$19.83	$62.38
Landscape Laborer	5/1/2024		$30.28	$24.05	$54.33
Landscape Laborer	5/1/2025		$31.73	$24.15	$55.88
Millwright	5/1/2025		$57.39	$35.81	$93.20
Millwright	5/1/2026		$60.20	$35.81	$96.01
Operators Class 01 - See Notes (Building, Heavy, Highway)	5/1/2025		$54.52	$34.49	$89.01
Operators Class 01 - See Notes (Building, Heavy, Highway)	5/1/2026		$55.67	$35.34	$91.01
Operators Class 01a - See Notes (Building, Heavy, Highway)	5/1/2025		$57.52	$35.38	$92.90
Operators Class 01a - See Notes (Building, Heavy, Highway)	5/1/2026		$58.68	$36.22	$94.90
Operators Class 02 - See Notes (Building, Heavy, Highway)	5/1/2025		$54.27	$34.42	$88.69
Operators Class 02 - See Notes (Building, Heavy, Highway)	5/1/2026		$55.43	$35.26	$90.69
Operators Class 02a - See Notes (Building, Heavy, Highway)	5/1/2025		$57.29	$35.29	$92.58
Operators Class 02a - See Notes (Building, Heavy, Highway)	5/1/2026		$58.44	$36.14	$94.58
Operators Class 03 - See Notes (Building, Heavy, Highway)	5/1/2025		$50.18	$33.22	$83.40
Operators Class 03 - See Notes (Building, Heavy, Highway)	5/1/2026		$51.34	$34.06	$85.40
Operators Class 04 - See Notes (Building, Heavy, Highway)	5/1/2025		$49.88	$33.13	$83.01
Operators Class 04 - See Notes (Building, Heavy, Highway)	5/1/2026		$51.04	$33.97	$85.01
Operators Class 05 - See Notes (Building, Heavy, Highway)	5/1/2025		$48.16	$32.62	$80.78
Operators Class 05 - See Notes (Building, Heavy, Highway)	5/1/2026		$49.32	$33.46	$82.78
Operators Class 06 - See Notes (Building, Heavy, Highway)	5/1/2025		$47.17	$32.33	$79.50
Operators Class 06 - See Notes (Building, Heavy, Highway)	5/1/2026		$48.34	$33.16	$81.50
Operators Class 07 (A) - See Notes (Building, Heavy,	5/1/2025		$66.26	$39.55	$105.81

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 26-09149 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Highway)					
Operators Class 07 (A) - See Notes (Building, Heavy, Highway)	5/1/2026		$67.73	$40.48	$108.21
Operators Class 07 (B) - See Notes (Building, Heavy, Highway)	5/1/2025		$65.97	$39.46	$105.43
Operators Class 07 (B) - See Notes (Building, Heavy, Highway)	5/1/2026		$67.44	$40.39	$107.83
Painters - Line Stripping	12/1/2024		$44.12	$27.91	$72.03
Painters - Line Stripping	12/1/2025		$45.12	$29.41	$74.53
Painters Class 2 (see notes)	2/1/2025		$50.85	$33.91	$84.76
Painters Class 2 (see notes)	2/1/2026		$51.61	$35.00	$86.61
Painters Class 3 (see notes)	2/1/2025		$61.81	$33.95	$95.76
Painters Class 3 (see notes)	2/1/2026		$62.57	$35.04	$97.61
Pointers, Caulkers, Cleaners	5/1/2025		$51.35	$31.80	$83.15
Steamfitters (Heavy and Highway - Gas Distribution)	5/1/2024		$66.80	$42.93	$109.73
Steamfitters (Heavy and Highway - Gas Distribution)	5/1/2025		$68.89	$44.73	$113.62
Truckdriver class 1(see notes)	5/1/2024		$36.64	$22.54	$59.18
Truckdriver class 1(see notes)	5/1/2026		$38.42	$23.87	$62.29
Truckdriver class 2 (see notes)	5/1/2024		$36.74	$22.54	$59.28
Truckdriver class 2 (see notes)	5/1/2026		$38.52	$23.87	$62.39
Truckdriver class 3 (see notes)	5/1/2026		$38.77	$23.87	$62.64

WEEKLY PAYROLL CERTIFICATION FOR PUBLIC WORKS PROJECTS

☐ Contractor or ☐ Subcontractor (Please check one) **ALL INFORMATION MUST BE COMPLETED**

CONTRACTOR ADDRESS	SUBCONTRACTOR ADDRESS	DEPARTMENT OF LABOR & INDUSTRY COMMONWEALTH OF PENNSYLVANIA BUREAU OF LABOR LAW COMPLIANCE PREVAILING WAGE DIVISION 7TH & FORSTER STREETS HARRISBURG, PA 17120 1-800-932-0665

PAYROLL NUMBER	WEEK ENDING DATE	PROJECT AND LOCATION PROJECT SERIAL # PROJECT #

EMPLOYEE NAME	APPR. RATE (%)	WORK CLASSIFICATION	DAY AND DATE Su M Tu W Th F Sa HOURS WORKED EACH DAY	S-TIME 0-TIME	BASE HOURLY RATE	TOTAL FRINGE BENEFITS (C=Cash) (FB=Contributions)*	TOTAL DEDUCTIONS	GROSS PAY FOR PREVAILING RATE JOB(S)	CHECK #
						C: FB:			
						C: FB:			
						C: FB:			
						C: FB:			
						C: FB:			

*SEE REVERSE SIDE

PAGE NUMBER _____ OF _____

THE NOTARIZATION MUST BE COMPLETED ON FIRST AND LAST SUBMISSIONS ONLY. ALL OTHER INFORMATION MUST BE COMPLETED WEEKLY.

*FRINGE BENEFITS EXPLANATION (FB): Bona fide benefits contribution, except those required by Federal or State Law (unemployment tax, workers' compensation, income taxes, etc.)

Please specify the type of benefits provided and contributions per hour:

1) Medical or hospital care _____
2) Pension or retirement _____
3) Life insurance _____
4) Disability _____
5) Vacation, holiday _____
6) Other (please specify) _____

CERTIFIED STATEMENT OF COMPLIANCE

1. The undersigned, having executed a contract with _____
(AWARDING AGENCY, CONTRACTOR OR SUBCONTRACTOR)

_____ for the construction of the above-identified project, acknowledges that:

(a) The prevailing wage requirements and the predetermined rates are included in the aforesaid contract.

(b) Correction of any infractions of the aforesaid conditions is the contractor's or subcontractor's responsibility.

(c) It is the contractor's responsibility to include the Prevailing Wage requirements and the predetermined rates in any subcontract or lower tier subcontract for this project.

2. The undersigned certifies that:
   (a) Neither he nor his firm, nor any firm, corporation or partnership in which he or his firm has an interest is debarred by the Secretary of Labor and Industry pursuant to Section 11(e) of the PA Prevailing Wage Act, Act of August 15, 1961, P.L. 987 as amended, 43 P.S.§ 165-11(e).

   (b) No part of this contract has been or will be subcontracted to any subcontractor if such subcontractor or any firm, corporation or partnership in which such subcontractor has an interest is debarred pursuant to the aforementioned statute.

3. The undersigned certifies that:
   (a) the legal name and the business address of the contractor or subcontractor are: _____
   _____

   (b) The undersigned is: ☐ a single proprietorship ☐ a corporation organized in the state of _____
   ☐ a partnership ☐ other organization (describe) _____

   (c) The name, title and address of the owner, partners or officers of the contractor/subcontractor are:

NAME	TITLE	ADDRESS

The willful falsification of any of the above statements may subject the contractor to civil or criminal prosecution, provided in the PA Prevailing Wage Act of August 15, 1961, P.L. 987, as amended, August 9, 1963, 43 P.S. § 165.1 through 165.17.

_____
(DATE)

_____
(SIGNATURE)

_____
(TITLE)

_____
SEAL

Taken, sworn and subscribed before me this _____ Day

of _____ A.D., _____

SECTION 011000 – SUMMARY OF THE PROJECT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work performed under Owner's separate contracts.
4. Work sequence and Contract Time.
5. Bid evaluation, award, and Responsible Contractors Ordinance.
6. Contractor's use of site and premises.
7. Coordination with occupants.
8. Work restrictions.
9. Specification and Drawing conventions.
10. Miscellaneous provisions.

B. Related Requirements:

1. Section 011200 "Multiple Contract Summary" for multiple contracts and Project Coordinator responsibilities.
2. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.
3. Section 017300 "Execution" for coordination of Owner-installed products.

1.3 PROJECT INFORMATION

A. Project Identification: Borough of Conshohocken Public Safety Facility. Project Location: 1111 Fayette Street, Conshohocken, PA 19428.

B. Owner: Borough of Conshohocken, 400 Fayette Street, Suite 200, Conshohocken, PA 19428. Telephone: 610-828-1092.

C. Owner's Representative Identification: Ray Sokolowski, Executive Director of Operations / Emergency Management Coordinator, Borough of Conshohocken, 400 Fayette Street, Suite 200, Conshohocken, PA 19428.

D. Architect Identification: Alloy5 Architecture, 530 West Broad Street, Bethlehem, PA 18018. Telephone: 610-419-4055. Architect's Representative: Giovanni Fuentes.

E. Project Coordinator and Mechanical/Electrical Coordinator for Multiple Contracts: Refer to Section 011200 "Multiple Contract Summary."

F. Web-Based Project Software: The Project Coordinator shall provide, as part of its Contract, project management software to be used for managing communication and documents during construction. See Section 013100 "Project Management and Coordination" for requirements.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:

1. A new public safety facility housing the Borough of Conshohocken's Fire and EMS services, together with a new community center. The building is Type IIB construction of approximately 31,000 square feet.
2. Demolition of existing buildings and existing foundations on the property.
3. New building construction and associated site work.
4. Traffic signal modernization.
5. New community area in the rear yard.

B. Project will be constructed under coordinated, concurrent multiple contracts. See Section 011200 "Multiple Contract Summary" for a list of multiple contracts, a description of work included under each of the multiple contracts, and the responsibilities of the Project Coordinator.

1. General (GC)
2. Mechanical (HC / MC / HVAC)
3. Electrical (EC)
4. Plumbing/Fire Protection (PC)
5. Traffic Signal Modernization (TC)

C. Testing:

1. Contractors are to perform all factory or shop testing and any other testing required.
2. Contractors are to perform any field testing of electrical systems or data wiring systems.
3. Contractors are to perform testing of above or below ground pipes, ductwork, and mechanical systems, including pressure, air, water, or vacuum testing required.
4. All Contractor testing shall be performed in the presence of the Owner's Representative and/or (if required) in the presence of the municipal agency having jurisdiction.

D. Construction Waste Management for all Project activities is by each Prime Contractor. Construction Waste Management for any demolition work and any site features is by the Contractor performing the work.

E. The Contractor responsible for installation of the systems and equipment is responsible for commissioning each system. The minimum commissioning requirements in accordance with Section 019113 and other specific project requirements, including coordination and verification, shall be the responsibility of the Contractor.

1.5 WORK PERFORMED UNDER OWNER'S SEPARATE CONTRACTS

A. Cooperate fully with Owner and separate Owner-hired firms and/or agencies so work may be carried out smoothly, without interfering with or delaying Work under this Contract. Coordinate the Work of this Contract with work performed under Owner's separate contracts.

1. Construction testing and special inspections will be by a separate firm hired by the Owner. The Owner will procure and bear costs for only the following: field testing for earthwork, concrete, masonry, asphalt and concrete paving, fireproofing, and structural steel.
2. Commissioning Verification Authority and HVAC testing, adjusting, and balancing (CVA/TAB) will be by a separate firm hired by the Owner and will require the participation and cooperation of all contractors. The Mechanical Contractor is responsible for all pressure testing of any pipes, ductwork, or field systems and for coordinating and supporting all testing and balancing.
3. Indoor Air Quality Testing is by Owner's independent testing agency.

4. Other contracts are at the Owner's sole discretion.

1.6 WORK SEQUENCE AND CONTRACT TIME

A. The Project is not phased. The entire Work of all contracts shall be constructed as a single, continuous sequence in compliance with the approved Project schedule, the erosion and sedimentation control plan(s), and the completion dates listed below. Any deviations from these requirements shall be subject to the approval of the Owner. The Owner reserves the right to enforce liquidated damages for Contractor's non-compliance with the Substantial Completion and Final Completion dates.

B. Key Dates:

1. Notice of Intent to Award: December 16, 2026 (anticipated). See Article "Bid Evaluation, Award, and Responsible Contractors Ordinance" below.

2. Notice to Proceed: January 6, 2027, contingent upon approval of the award by Conshohocken Borough Council and issuance of the Borough's written contractor responsibility determination.

3. Completion for all contracts is as follows:

a. Substantial Completion – June 5, 2028.

b. Final Completion – June 30, 2028.

C. The Contractors' sequence and CPM schedule shall incorporate and comply with the dates listed above. The completion dates provided will be enforced.

D. Construction work for the building shall be performed in a sequence to ensure that all building systems are systematically installed in an efficient manner. Mechanical and electrical rooms shall be constructed early in the sequence to permit rough-in by the Mechanical, Electrical, and Plumbing trades.

E. Contractors are to clean and turn over the building to the Owner for Owner fit-out needs, but not occupancy, at least one month prior to the Substantial Completion date.

F. If the Notice to Proceed is delayed for any reason, the Substantial Completion and Final Completion dates will be adjusted by the exact same number of days.

G. Liquidated damages apply to the Substantial Completion and Final Completion dates in the amount(s) stated in the Agreement and section 007300 - Supplementary Conditions.

H. All Work must be completed in accordance with the erosion and sedimentation control plan(s), the Project NPDES permit requirements (where applicable), the approved Project schedule, and in a sequence approved by the Architect, Engineer, and Owner. Where an NPDES permit is required, each Prime Contractor shall be a co-permittee on the Owner's NPDES permit and shall submit the appropriate application forms to the Montgomery County Conservation District.

1.7 BID EVALUATION, AWARD, AND RESPONSIBLE CONTRACTORS ORDINANCE

A. This Project is subject to the Borough of Conshohocken Responsible Contractors Ordinance (RCO), Borough Code Chapter 13, Sections 121 through 130. Compliance with the RCO is a condition of award and of performing Work on this Project.

B. Following bid opening, the apparent lowest responsive bidder for each prime contract shall submit the Borough of Conshohocken "Contractor/Subcontractor Responsibility Certification" and all supporting documentation required by the RCO, within the time stated in the Instructions to Bidders and section 006218.00 Contractors Responsibility Requirements. The Borough may require any additional information it deems necessary to evaluate a firm's status as a responsible contractor, including technical qualifications, financial capacity or other resources, and performance record.

C. Each Prime Contractor shall ensure that its subcontractors of every tier performing Work on the Project comply with the RCO and submit Contractor/Subcontractor Responsibility Certifications as required by the RCO, including for subcontractors added after award.

D. Notice of Intent to Award will be issued conditioned upon the issuance of a written contractor responsibility determination in accordance with the RCO. If a bidder is not determined to be a responsible contractor, the Borough may review the bid received from the next lowest responsive bidder for compliance with the RCO.

E. Award of Contracts and issuance of the Notice to Proceed are contingent upon approval by Conshohocken Borough Council. Contract Time shall not commence until the Notice to Proceed is issued.

F. Compliance with the RCO shall be maintained for the duration of the Contract.

1.8 CONTRACTOR'S USE OF SITE AND PREMISES

A. General: Contractors shall have limited use of the Project site for construction operations within the Contract limits indicated on the Drawings and as indicated by requirements of this Section and Section 015000 "Temporary Facilities and Controls." Do not disturb portions of the Project site beyond areas in which the Work is indicated.

B. Contractors must coordinate activities and cooperate with adjacent uses and properties. Schedule, coordinate, and perform construction activities, including street, traffic signal, and utility work, to avoid disruption of public streets, sidewalks, and emergency vehicle access. Work on public streets and rights-of-way shall comply with requirements of the Borough and authorities having jurisdiction and may require work on weekends or holidays.

C. Contractors shall place trailers and materials in designated areas as indicated on the Drawings and in coordination with the Project Coordinator and Owner's Representative.

D. Schedule deliveries to minimize use of public streets and to minimize space and time requirements for storage of materials and equipment on site.

E. Burial of waste materials is not permitted.

1.9 COORDINATION WITH OCCUPANTS

A. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations.

1. Maintain access to existing walkways and other adjacent occupied or used site facilities. Do not close or obstruct walkways, driveways, or other occupied or used areas without written permission from Owner and approval of authorities having jurisdiction.

B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

1. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.

2. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.

1.10 WORK RESTRICTIONS

A. Comply with restrictions on construction operations, and with limitations on use of public streets, work on public streets, rights-of-way, and other requirements of the Borough of Conshohocken and authorities having jurisdiction.

B. On-Site Work Hours: Limit work to between 7:00 a.m. and 5:00 p.m., Monday through Friday, unless otherwise indicated or required by the Borough of Conshohocken Code. Work hours may be modified to meet Project requirements if approved in writing by Owner and authorities having jurisdiction.

1. Weekend and Holiday Work: Only with Owner's written approval and in compliance with Borough requirements.

C. Existing Utility Interruptions: Do not interrupt utilities serving adjacent properties or public facilities unless permitted under the following conditions and then only after arranging for temporary utility services according to requirements indicated:

1. Notify Owner not less than two days in advance of proposed utility interruptions.

2. Obtain Owner's written permission and approval of the utility company before proceeding with utility interruptions.

D. Noise, Vibration, Dust, and Odors: Coordinate operations that may result in high levels of noise and vibration, dust, odors, or other disruption to adjacent properties with Owner. Notify Owner not less than two days in advance of proposed disruptive operations and obtain Owner's written permission before proceeding.

E. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances on Owner's property is not permitted.

1.11 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Technical Specifications are organized into Divisions and Sections using the CSI/CSC's "MasterFormat" numbering system.

1. Section Identification: The Specifications use section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of sections in the Contract Documents.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred, as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.

2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the section text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

c. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

d. All references to days shall mean calendar days unless otherwise designated.

C. Division 00 Procurement and Contracting Requirements: General provisions of the Contract, including the General Conditions, apply to all Sections of the Specifications.

D. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

E. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications.

1.12 MISCELLANEOUS PROVISIONS

A. Local Municipal Approvals & Permits: The Contractor shall submit, with NO mark-up, the cost of building permits and inspection fees required for the work. The Owner will reimburse the Contractor for fees paid to the authorities

having jurisdiction. The Contractor shall secure and arrange for all the necessary utility connections and municipal or agency approvals or permits required for the Project unless specified otherwise.

B. Contractors must obtain all necessary state, county, or local municipal approvals prior to Substantial Completion.

C. Prior to acceptance as substantially complete, all general construction and all mechanical, electrical, and plumbing systems shall be complete, fully operational, tested as required, inspected by approval authorities, and certified complete.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL

A. Contractor shall complete all work in the time period specified in the Contract. Contractor(s) shall include all necessary time and the related cost required, including but not limited to overtime, shift work, weekends, and holidays, in order to complete the work as specified within the Contract Time.

END OF SECTION 011000

SECTION 011200 - MULTIPLE CONTRACT SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes a summary of each contract, including responsibilities for coordination and temporary facilities and controls.

B. Specific requirements for Work of each contract are also indicated in individual Specification Sections and on Drawings.

C. Related Sections include the following:

1. Division 01 Section 011100 "Summary of the Project" for the Work covered by Contract Documents and for work sequence.
2. Division 01 Section 011400 "Work Restrictions" for use of the Project site and for requirements for continued Owner occupancy of premises.
3. Division 01 Section 013100 "Project Management and Coordination" for general coordination requirements.
4. Division 01 Section 015000 "Temporary Facilities and Controls" for specific requirements for temporary facilities and controls.
5. Division 01 Section 011500 “Field Engineering” for specific requirements of field engineering services.
6. Division 01 Section 017419 “Construction Waste Management” for additional information and procedures.
7. Division of Section 019113 “General Commissioning Requirements” for additional information and procedures.

1.3 DEFINITIONS

A. Permanent Enclosure: As determined by Architect and permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial (watertight and insulated) temporary closures.

B. Coordinate: The term “coordinate” means “to cooperate with related trades to furnish and install all connections between the trades in correct sequence size and location to create a complete system ready for intended use.”

C. Verify: The term “verify” means “to measure, investigate, review, test, check the accuracy or correctness of, and prove by demonstration, evidence, or testimony the location, size, dimension, and condition of an item.”

D. Furnish: The term “furnish” is used to mean “supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, and similar operations.”

E. Install: The term “install” is used to describe operations at the project site including the actual “unloading, unpacking, assembly, erection, placing, anchoring, applying, working to

dimension, finishing, curing, performing, coordinating with other trades, protecting, cleaning, and similar activities."

F. Provide: The term "provide" means "to furnish and install, complete, and ready for the intended use."

1.4 COORDINATION

A. Project Coordinator shall be responsible for coordination between the General Construction Contract, Plumbing Contract, HVAC (also referenced as Mechanical) Contract, Electrical, and Traffic Signal Contract.

1. General Construction Contractor shall act as and assume responsibilities of Project Coordinator which are designated throughout the Contract Documents.

B. HVAC, Plumbing/Fire Protection, Electrical Traffic Signal Coordinators, who shall be subordinate to Project Coordinator, shall be responsible for coordination between the Plumbing Contract, HVAC Contract, and Electrical Contract. The HVAC Contractor shall be responsible for the assembly of coordination drawings for himself and the inclusion of coordination drawings provided by the Electrical and Plumbing Contractors. The HVAC (Mechanical) Contractor shall be the primary M/E/P coordinator and shall be responsible for the preparation of AutoCAD electronic coordination drawings between HVAC, plumbing, and electrical trades. The Plumbing and Electrical Contractors shall provide such information electronically to fully coordinate their work with that of the other primes and in the format requested by the HVAC Contractor. All Prime Contractors shall cooperate and be responsible for preparation and compliance with coordination drawings. See Section 013117 for requirements for all Prime Contractors.

C. GC shall coordinate all work in accordance with project phasing requirements and scheduled activities of all other contractors. GC shall perform cutting and patching of all roofing materials including metal deck. Any structural reinforcement required is by the General Contractor.

D. The GC shall be responsible to maintain watertight conditions between the roof and curbs, pipes, and conduits for both permanent and temporary flashing. The MC, PC, and EC shall be responsible for providing temporary enclosures that are watertight for all roof penetrations and openings that are part of their scope in order to maintain watertight conditions beyond the roofer's flashings.

1.5 PROJECT COORDINATOR RESPONSIBILITIES

A. Project Coordinator: Full-time Project Coordinator shall be experienced in administration and supervision of building construction, including HVAC, plumbing, and electrical work.

1. Coordination activities of Project Coordinator include, but are not limited to, the following:

a. Provide overall coordination of the Work.

b. Coordinate shared access to workspaces.

c. Coordinate product selections for compatibility.

d. Provide overall coordination of temporary facilities and controls.

e. Coordinate, schedule, and approve interruptions of permanent and temporary utilities, including those necessary to make connections for temporary services.

f. Coordinate construction and operations of the Work with work performed by each Contract.

g. Prepare Coordination Drawings to coordinate work by more than one contract except for HVAC, electrical, and plumbing coordination drawings which are the responsibility of the respective Contractors and primarily the HVAC Contractor.

h. Coordinate sequencing and scheduling of the Work. Include the following:

1) Initial Coordination Meeting: At earliest possible date, arrange and conduct a meeting with contractors for sequencing and coordinating the Work; negotiate reasonable adjustments to schedules.

2) Prepare a combined Contractor's Construction Schedule for entire Project. Base schedule on Preliminary Construction Schedule. Secure time commitments for performing critical construction activities from contractors. Show activities of each contract on a separate sheet. Prepare a summary sheet indicating combined construction activities of contracts.

a) Submit schedules for approval.

b) Distribute copies of approved schedules to Architect, Owner, and contractors.

i. Provide quality-assurance and quality-control services specified in Section 014000 "Quality Requirements."

j. Coordinate sequence of activities to accommodate tests and inspections, and coordinate schedule of tests and inspections.

k. Provide information necessary to adjust, move, or relocate existing utility structures affected by construction.

l. Perform field engineering, construction layout, and locate existing permanent benchmarks and control points. Provide similar reference points and establish permanent benchmarks, control points, and elevations on project site for use by other prime contractors and all trades.

m. Provide field surveys of in-progress construction and site work.

n. Provide progress cleaning of common areas and coordinate progress cleaning of areas or pieces of equipment where more than one contractor has worked. Progress cleaning of building and site shall be performed on a daily basis. Site cleaning shall include removal of mud and debris from all areas and in particular all sidewalks and streets.

o. Provide final cleaning of building except for floor waxing.

p. Coordinate cutting and patching.

q. Coordinate protection of the Work.

r. Coordinate firestopping.

s. Coordinate completion of interrelated punch list items.

t. Coordinate preparation of Project Record Documents if information from more than one contractor is to be integrated with information from other contractors to form one combined record.

u. Collect Record Specification Sections from other contractors, collate Sections into numeric order, and submit complete set.

v. Coordinate preparation of operation and maintenance manuals if information from more than one contractor is to be integrated with information from other contractors to form one combined record.

w. Coordinate efforts to meet the requirements for all Contractors and Subcontractors to dispose of their construction waste in accordance with the Construction Waste Management Plan in compliance with Section 017419.

B. HVAC, Plumbing, and Electrical Coordinators: Full-time HVAC, Plumbing, and Electrical Coordinators shall be experienced in coordination of HVAC, plumbing, and electrical construction, including coordination of type of operations required for this Project.

1. Coordination activities of HVAC, Plumbing, and Electrical Coordinators include, but are not limited to, the following:

a. Schedule and sequence HVAC, plumbing, electrical, and general construction activities.

b. Coordinate sharing access to workspaces by HVAC, electrical, and plumbing contractors.

c. Coordinate integration of HVAC, electrical, and plumbing work into limited spaces.

d. Coordinate protection of HVAC, electrical, and plumbing contractors' work.

e. Coordinate cutting and patching for HVAC, electrical, and plumbing work.

f. Prepare HVAC, electrical, and plumbing Coordination Drawings.

g. Coordinate tests and inspections for HVAC, electrical and plumbing work.

h. Coordinate HVAC, electrical, and plumbing temporary services and facilities.

2. Refer to Section 013117 Coordination Drawings for specific requirements.

1.6 GENERAL REQUIREMENTS OF CONTRACTS

A. Extent of Contract: Unless the Contract Documents contain a more specific description of the Work, names, and terminology on Drawings and in Specification Sections determine which contract includes a specific element of Project.

1. Unless otherwise indicated, the Work described in this Section for each contract shall be complete systems and assemblies, including products, components, accessories, and installation required by the Contract Documents.

2. Local custom and trade-union jurisdictional settlements do not control the scope of the Work of each contract. When a potential jurisdictional dispute or similar interruption of work is first identified or threatened, affected contractors shall negotiate a reasonable settlement to avoid or minimize interruption and delays.

3. Trenches for the Work of each contract shall be provided by each contract for its own Work unless noted otherwise.

4. Cutting and patching for the Work of each contract shall be provided by each contract for its own Work except where indicated otherwise on the Drawings or Specifications. Refer to Section 017329 Cutting and Patching.

5. Firestopping for the Work of each contract shall be provided by each contract for its own Work.

6. Submit schedules showing construction operations sequenced and coordinated with overall construction and provide all scheduling and coordination information required for the complete scope of work.
7. Refer to Section 011500 “Field Engineering’ specification for responsibilities of each trade.

B. Substitutions: Each contractor shall cooperate with other contractors involved to coordinate approved substitutions with remainder of the Work.

C. Temporary Facilities and Controls: See specific responsibilities for temporary facilities and controls indicated in Division 01 Section "Temporary Facilities and Controls," and noted on the Contract Documents.

D. The Contractor responsible for installation of the systems and equipment is responsible for commissioning each system. The minimum commissioning requirements in accordance with Section 019113 and other specific project requirements, including coordination and verification, shall be the responsibility of the Contractor.

1.7 MULTIPLE PRIME COORDINATION CLARIFICATIONS

A. General Contractor shall furnish and install lintels and structural supports required for openings and recesses in new construction to allow the passage of the Work of his Contract and the Work of the Plumbing/Fire Protection, HVAC, and Electrical Prime Contracts.

B. General Contractor shall also provide chases and openings 12” x 12” or larger for equipment in new construction, including all roof areas, as directed, supervised, located, marked, and configured within the project structure, by the Plumbing, HVAC, and Electrical Prime Contractors' personnel on site. These openings shall be sealed by the prime contractor requiring the opening. All sleeves, conduits, and sealing of the same shall be furnished and installed by the prime contractor that requires the access for installation of systems. Roofing Subcontractor to the GC shall perform cutting and patching of roof materials as directed by the other Prime Contractors for the implementation of their work.

C. The Prime Contractors shall be responsible to seal all roof openings. GC and Roofing Subcontractor are responsible up to curb flashings. The HVAC Contractor shall layout all openings and curbs and shall provide all roof curbs to GC for installation. GC shall provide all blocking and accessories to install curb(s). Roofing subcontractor will provide all permanent roofing and flashing to the curbs. HVAC Contractor is responsible to seal any temporary or permanent openings and install new equipment keeping the opening watertight at all times.

D. During placement of concrete slabs, each Prime Contractor that has rough-in requirements in the slab shall provide on-site personnel while slabs are being poured to direct, supervise, locate, mark, and configure rough-in requirements. Sleeves required for floor, wall, and roof penetrations shall be furnished and installed by the Prime Contractor(s) that require the sleeves. The Prime Contractor using the sleeves is responsible for installing sealant, fire-safing, and/or escutcheons necessary for a finished installation.

E. Prime Contractors who fail to properly coordinate their work in new construction work and whose work requires an opening, or recess, in completed construction shall be responsible to provide that alteration; to furnish and install lintels and structural supports required; and to patch the construction to match the completed unaltered.

F. General Contractor shall apply sealant around wall mounted outside air intake louvers provided and installed by the HVAC Contractor.

G. General Contractor shall provide sanitary and storm sewer system from a point five feet outside the perimeter of the building, unless noted otherwise. Plumbing Contractor shall provide sanitary and storm system within building, including open air enclosed courtyards, and underground to a point five feet outside the building perimeter, unless noted otherwise, and shall make final connection to storm and sanitary system. The Plumbing Contractor shall provide and install grease interceptor and make final connection to sanitary sewer piping outside the building and five feet beyond final connection with sanitary system.

1. General Contractor shall provide gravity sewer line from 5' outside of the building to manhole as noted on civil drawings. General Contractor to provide and install all cleanouts and covers outside of the building. Plumbing Contractor to provide sewage piping to 5' outside of the building and final connection to the gravity sewer line.
2. General Contractor shall provide exterior stormwater conveyance including exterior gutters, downspouts, and leaders to below grade.
3. For interior roof drainage, General Contractor to furnish and install roof drains and emergency roof drains. (Roof drains specified in Plumbing specifications and indicated on plumbing drawings.) Plumbing Contractor to connect to roof drain outlet and extend piping from roof drains to 5’-0” beyond building with final connection to site storm piping. Plumbing Contractor to connect to emergency roof drains and extend piping to termination location as indicated on plumbing plans with all required termination fittings.

H. General Contractor shall provide domestic and fire suppression water supply system from a point five feet outside the perimeter of the building unless noted otherwise. Plumbing Contractor shall provide plumbing water supply system within building and underground to a point five feet outside the building perimeter and shall make final connection to water supply system. The Plumbing Contractor shall provide fire suppression system within building and underground to a point five feet outside the building perimeter, unless noted otherwise, and shall make final connection to water supply system.

I. General Contractor shall be responsible for all food service equipment.

J. General Contractor responsibilities for gas service shall be excavation/trenching, installation of screening bed for gas piping and backfill of any trenching or related excavation for the gas line installation. All work to be in accordance with PECO specifications and requirements.

K. Plumbing Contractor shall provide all gas service piping throughout building and shall make final connections to equipment.

L. Food Service Equipment Contractor (General Contractor) shall furnish dry contacts for interconnection with building alarm, mounting curbs and pipe portals, and drain pan to appropriate contractors for installation. Electrical Contractor shall install dry contacts and final connections to building alarm system. General Contractor shall install mounting curbs and pipe portals. Roofing Contractor (General Contractor) shall provide flashing. Plumbing Contractor shall install drain pan and final connections.

M. Plumbing Contractor shall make final connections and shall provide valved connections to make-up water feeders to loop water system and dual temperature system, as indicated.

N. The Electrical Contractor shall lock out and tag circuit breakers and switches and shall check cables and wires to ensure they are de-energized to ground potential before Work begins.

O. Electrical Contractor shall provide electrical service and connection of food service equipment and auxiliary equipment.

P. Plumbing Contractor shall provide water and sewer connections to food service and auxiliary equipment.

Q. Plumbing Contractor shall make final connections on gas-fired equipment as indicated including all kitchen equipment and emergency generator.

R. Plumbing Contractor shall provide devices for food service equipment such as hose bibbs, washing machine outlet box, water conditioner, water filter, and pet cock for icemaker, hose reel with control units.

S. Interior concrete bases and pads required for plumbing, fire suppression, heating, ventilation, and air conditioning, and electrical equipment shall be provided by the contractor installing the equipment unless noted otherwise.

T. General Contractor shall provide all exterior concrete pads and bases with exception of exterior light bases, generator pad, and transformer pad. Exterior light pole bases, generator pads, and transformer pads are by the Electrical Contractor.

U. HVAC and Plumbing Contractors shall provide control interlock wiring for their associated system equipment.

V. Electrical Contractor shall provide disconnect switches for HVAC and Plumbing system equipment except where such items are factory installed as an integral part of the equipment.

W. Electrical Contractor shall provide manual motor starters, or magnetic motor starters, for HVAC and Plumbing equipment except where such equipment is provided with factory installed starters as an integral part of the equipment or equipment control panel. Variable frequency drives shall be an integral part of HVAC equipment and HVAC variable speed pumping package.

X. Electrical Contractor shall provide fuses for disconnects and disconnect/starter switches. HVAC and Plumbing Contractors shall furnish the Electrical Contractor with required motor data to properly size and select fuses and overload protection in accord with the National Electrical Code requirements. HVAC and Plumbing Contractors shall furnish to the Electrical Contractor the equipment manufacturers' circuit protection data.

Y. Where fireproofing is indicated for the project, each Prime Contractor shall install clips, hangers, supports, sleeves, runners, and other items required prior to installation of fireproofing. Each Prime Contractor shall protect fireproofing material; damages to fireproofing shall be repaired by the General Contractor and charged to the Prime Contractor responsible for the damage; this includes items installed out of sequence.

Z. Plumbing, HVAC, and Electrical Contractors shall provide miscellaneous steel members for support of hanging systems installed under their contract and shall reinforce joists for non-panel point concentrated loads. When run parallel to joists, hanging systems shall be supported from steel installed perpendicular to joists and spanning a minimum of three (3) joists. All miscellaneous steel required shall be provided by contractor installing the systems under their contract; do not use joists for support. Supporting from metal roof deck and deck systems is prohibited.

AA. All grease waste piping inside and outside of the building is by the Plumbing Contractor. The complete grease interceptor system shall be by the Plumbing Contractor including site piping beyond 5'-0".

BB. General Contractor shall provide door louvers.

CC. HVAC Contractor shall install ductwork extension from dryer and for dishwasher and make final connections. HVAC Contractor shall install ductwork extension from fume hoods and make final connections.

DD. HVAC Contractor shall set controls, panelboards, and appurtenances installed in pipelines and ductwork and shall provide control wiring.

EE. Electrical Contractor shall provide devices, wiring within casework, and final connections for educational casework as provided for in the Contract Documents.

FF. Plumbing Contractor to provide all fixtures, traps, etc. to provide all installation and final connections of sinks, faucets, and fittings. Coordinate this work with the General Contractor as provided in the Contract Documents.

GG. Plumbing/Fire Protection Contractor to coordinate tie-in of sprinkler system to fire alarm system with Electrical Contractor. Plumbing Contractor to provide flow and tamper switches for connection to fire alarm system.

HH. Plumbing, HVAC, and Electrical Prime Contracts shall furnish any access panels which are required for access to their work. Coordinate opening requirements with the General Contractor for installation by GC.

II. HVAC Contractor to furnish and install all exterior vents and louvers.

JJ. The disconnection and/or reconnection of existing equipment shall be by the Plumbing/ HVAC/ Electrical Contractor as applicable.

KK. All roofing work will be performed by GC:

1. GC shall coordinate all work in accordance with project phasing requirements and scheduled activities of all other contractors. GC shall perform cutting and patching of all roofing materials including metal deck. Any structural reinforcement required is by the General Contractor.

2. The GC shall be responsible to maintain watertight conditions between the roof and curbs, pipes, and conduits for both permanent and temporary flashing. The MC, PC, and EC shall be responsible for providing temporary enclosures that are watertight for all roof penetrations and openings that are part of their scope in order to maintain watertight conditions beyond the roofer's flashings. GC is responsible to install all HVAC curbs and required leveling blocking. HVAC to furnish curbs and layout. GC responsible for up to curb flashing.

3. Reference Article 1.7.B of this Section for additional requirements.

1.8 MULTIPLE PRIME COORDINATION FOR ELECTRONIC/ELECTRIC TEMPERATURE CONTROLS, Division 23

A. The HVAC Contractor is defined herein to include the work of the Mechanical Contractor, H.C., M.C., ATC Sub-Contractor, and/or BAS Contractor.

B. The HVAC Contractor shall provide wiring, fiber, and data cable between all Ethernet Network Controllers Standalone Digital Control Units, workstations, software, sensors, transducers, relays, valves, dampers, damper operators, control panels, and other accessory equipment, along with a complete system of electrical interlocking wiring to fill the intent of the specification and provide for a complete and operable system as specified in Division 23.

C. The Electrical Contractor shall provide electric power wiring to new plumbing and HVAC equipment. HVAC Contractor shall provide electric power wiring and control wiring for ATC equipment and devices.

D. The Electrical Contractor shall furnish and install duct smoke detectors at locations designated by the Mechanical Contractor and wire to the ATC/BAS system. The Electrical

Contractor shall connect each smoke detector to the building fire alarm system. ATC/BAS Sub-Contractor shall provide interconnecting wiring to de-energize the fan.

E. The Electrical Contractor shall provide the kW/KWH transducer specified at each secondary metering location. The HVAC contractor shall provide control wiring to the points specified.

F. The Electrical Contractor shall provide auxiliary contacts on generator/transfer switch as required in the points list in Division 23. The HVAC Contractor shall provide control wiring to the points.

G. The HVAC Contractor shall provide all interlock wiring specific to equipment.

1.9 GENERAL CONSTRUCTION CONTRACT (Contract No. 1)

A. The Work under the General Construction Contract includes site work, demolition, architectural and structural construction, and other activities traditionally recognized as general construction required by any of the Contract Documents including, but not limited to, the architectural, civil, and structural drawings, specification Divisions 00 through 14, 31, 32 and 33, except when specifically assigned to another Contract for construction. Work in the General Construction Contract includes, but is not limited to, the following:

1. Field engineering, site, and building layout.
2. Temporary Erosion and Sediment controls.
3. Temporary construction fence and temporary roadways.
4. Temporary staging area.
5. Site preparation, including demolition, clearing, and earthwork.
6. Site restoration including clearing, demolition of all existing site amenities underground fuel oil tank and utilities as indicated on the civil plans and returning the site to new condition.
7. Construction waste management for the entire Project and implementation of a Construction Waste Management Plan (CWMP) for the Project. Coordination and preparation of final CWM report with information provided by all Prime Contractors.
8. Site improvements, including roadways, parking lots, site development furnishings and equipment, pedestrian paving, and landscaping.
9. Site utility piping and trenches shown on site drawings or referenced from site drawings.
10. Excavation and backfill of all site and utility trenches unless noted as responsibility of other contractors.
11. Site water supply and distribution.
12. Site sanitary sewer.
13. Site storm sewer.
14. Site stairs, rails, and walls.
15. Natural gas service to meter as noted above and in accordance with PECO requirements.
16. Lawns and landscaping.
17. Asphalt and concrete paving and curbs.

18. Road improvements and site signage as indicated.
19. Foundations, including footings, foundation walls.
20. Slabs-on-grade, including earthwork, sub-drainage systems, and insulation.
21. Below-grade building construction, including excavation, backfill, and thermal and moisture protection.
22. Superstructure, including floor and roof construction.
23. Insulation and fireproofing.
24. Exterior closure, including walls, doors, windows.
25. Masonry work, rough and finish carpentry.
26. All roofing, scuttles and roof accessories.
27. Framing for all roof and floor openings and supported equipment, including coordination for all roof work.
28. All roofing, roof drains, roofing accessories, installation of HVAC roof curbs, all blocking required for installation.
29. Interior construction, including partitions, doors (wood, hollow metal, aluminum, etc.), fittings, finish, hardware, and glazing.
30. Fire suppression specialties and fire-rated framing and glass.
31. Stairs, including railings and finishes.
32. Finishes.
33. Food service equipment and work.
34. Lockers.
35. Furnishings, including casework, specialty casework, and window treatments.
36. Conveying systems.
37. Firestopping of General Contractor work.
38. Temporary fire protection including, but not limited to, fire extinguishers.
39. Openings including windows, doors, and hardware. Provide all aluminum windows, storefronts, entrance doors, curtainwalls, glass, and glazing.
40. Specialties.
41. Starting, commissioning, adjusting, and training of all General Construction systems and equipment in accordance with manufacturers' recommendations and in conjunction with Owner's Commissioning Verification and Testing Agent(s).
42. Provide all drywall, metal studs, insulation, wood, acoustical ceilings and grid.
43. Provide all expansion joints and covers.
44. Installation of Owner-furnished items as noted on the plans and specifications.
45. Provide all blocking necessary to install Owner-furnished items.

1.10 HVAC CONTRACT (HC/MC/HVAC) (Contract No. 2)

A. The Work under the HVAC Construction Contract includes all construction and other activities traditionally recognized as mechanical work required by any of the Contract

Documents including, but not limited to, the HVAC drawings, specification Divisions 00, 01, 02, 03, 07, 11, 13, 14, 23 and 31 except when specifically assigned to another contract for construction. Work in the HVAC Contract includes, but is not limited to, the following:

1. All HVAC work as shown and specified.
2. Reclamation of existing refrigerants form existing mechanical units to be demolished.
3. Boiler systems.
4. Loop water systems.
5. Exhaust fan systems.
6. HVAC distribution including piping and ductwork.
7. Terminal and packaged units.
8. Energy recovery and other specialty HVAC equipment.
9. HVAC instrumentation and controls including ATC/FMS.
10. Air handling units.
11. All insulation for HVAC systems.
12. All ductwork accessories including grilles, registers, and diffusers.
13. Starting, commissioning, adjusting, and training for all HVAC systems and equipment.
14. Coordination of HVAC commissioning, testing, adjusting, and balancing in conjunction with the Owner's Commissioning Verification and Testing Agent(s).
15. Coordinate work with all contractors including, but not limited to electrical, general, and plumbing contractors. Coordinate and confirm locations and rough-in for all work with all contractors. Make location adjustments as required.
16. Mechanical connections to equipment furnished under other contracts including dryer vents.
17. All roof curbs and accessories for HVAC equipment including louvers and vents. MC shall furnish curbs and layout for installation by GC.
18. Preparation of ductwork and HVAC/electrical coordination drawings.
19. Firestopping of HVAC Contractor Work.
20. Provide temporary heat, as required; refer to Section 015000.
21. Provide temporary dust and fume control machines as required.

1.11 ELECTRICAL CONTRACT (EC) (Contract No. 3)

A. The Work under the Electrical Construction Contract includes all construction and other activities traditionally recognized as electrical work required by any of the Contract Documents including, but not limited to, the electrical drawings, specification Divisions 00, 01, 02, 03, 07, 08, 11, 12, 13, 14, 26, 27, 28, 31 and 33 except when specifically assigned to another contract for construction. Work in the Electrical Contract includes, but is not limited to, the following:

1. Demolition of existing electrical systems as noted on the Construction Documents.
2. Site excavation required for electrical systems.

3. Site electrical distribution.
4. Site lighting including site pole concrete footing and bases.
5. Site communications and security.
6. Electrical distribution.
7. Electrical grounding.
8. Lighting and power branch wiring.
9. Communication and systems.
10. Special electrical systems, including the following:
    a. Packaged engine generator systems.
11. Electrical connections to equipment furnished under other contracts.
12. Structural supports, hangers, sleeves, and inserts.
13. Perform all starting, commissioning, testing, adjusting, balancing and training of all electrical systems and equipment in accordance with the manufacturers' recommendations and in conjunction with the Owner's Commissioning Verification and Testing Agent(s).
14. Luminaires, lighting controls and all accessories.
15. Fire detection and notification systems.
16. Conduits and raceway for special systems as required.
17. Card access system.
18. Intrusion detection system.
19. Alerting system.
20. Door access and security systems as defined in Division 08 specifications.
21. Emergency lighting systems.
22. Coordinate work with all contractors including, but not limited to plumbing, general and HVAC contractors. Coordinate and confirm locations and rough-in for all work with all contractors. Make location adjustments as required.
23. Cable tray for all work as specified.
24. Raceways for all work.
25. Spare site underground conduits.
26. All rough-in including conduit, pull wire in conduit, and back boxes for all work.
27. Floor and wall boxes for all work.
28. Data and telephone wiring installed in raceways, conduits, sleeves, and cable tray.
29. Data jacks and related data equipment.
30. Wireless access system (conduit, Cat 6 cable, patch cord and wireless access point in ceiling).
31. Wiring, terminations, accessories for complete CCTV system. (conduit and Cat 6 cable).
32. Furnish and install all accessories, hangers, Velcro wraps, etc.

33. Provide electrical dimensions and drawings and assisting HVAC Contractor in preparation of coordination drawings.
34. Firestopping of Electrical Contractor Work.
35. Furnish and install Cat 6 feeder wires for phones and data.
36. Furnish and install racks, patch panels, cross connect and punch blocks.
37. Furnish and install wall jacks and face plates.
38. Provide equipment and all necessary wiring for interfacing of the following systems:
    a. HVAC equipment
    b. Temperature control
    c. Plumbing equipment
39. Provide final electrical power connection of casework. Provide all electrical wiring and devices within casework.
40. Furnish and install phones, path cables, PA speakers, exterior door access systems, security cameras, network switches, audio enhancement system, and projectors as described in Contract Documents.
41. The EC is responsible for maintaining power to all areas of the occupied building for all phases of the project. Also see Section 01 5000 “Temporary Facilities and Controls” for temporary power needs.
42. Coordinate utility transformer installation and all primary and secondary cable terminations with local utility.
43. Coordinate, furnish and install conduit, ductbank vaults, etc. for underground power coming onto the site and all underground power to new transformer and electrical switchgear as shown on drawings and in compliance with PECO requirements.

1.12 PLUMBING CONTRACT (PC) (Contract No. 4)

A. The Work under the Plumbing Construction Contract includes all construction and other activities traditionally recognized as plumbing work required by any of the Contract Documents including, but not limited to, the plumbing drawings, specification Divisions 00, 01, 02, 03, 07, 11, 12, 13, 21, 22 and 31 except when specifically assigned to another contract for construction. Work in the Plumbing Contract includes, but is not limited to, the following:

1. Provide demolition of water service and existing plumbing systems, equipment and accessories as noted and required on the Construction Documents. Disconnect and cap all utilities to plumbing items.
2. Storm sewer and water service from five (5) feet outside building.
3. Domestic water distribution, including main water service systems.
4. Plumbing fixtures including domestic water heater, combustion air, and vent.
5. Sanitary waste.
6. Natural gas piping.
7. Stormwater drainage.
8. Fire suppression sprinklers including pumps, sprinkler piping, heads, flow and tamper switches, corrosion mitigation system, trim, accessories, and support.

9. Fire suppression hydraulic calculations to size fire suppression system.
10. Perform all required Fire Protection system flushes and fills.
11. Plumbing connections to equipment furnished by the General Construction Contract, Plumbing Contract, HVAC Contract and Electrical Contract.
12. Preparing of sprinkler and plumbing drawings and assisting HVAC Contractor in preparation of coordination drawings.
13. Coordinate work with all contractors including, but not limited to electrical, general and HVAC contractors. Coordinate and confirm locations and rough-in for all work with all contractors. Make location adjustments as required.
14. Roof drain piping installation.
15. Food Service connections and accessories.
16. Firestopping of Plumbing Contractor Work.
17. Grease waste piping inside the building and grease interceptor including final connection to sanitary sewer and 5’ beyond connection with sanitary sewer.
18. Provide and connect oil/water separator and plumbing for all trench drains.
19. Provide temporary water service for construction per Temporary Facilities.
20. Maintain operation of existing systems at occupied areas.
21. Contractor shall include temporary feeds (including additional piping and valves) and connection to permanent system.
22. Perform all starting, commissioning, testing, adjusting, balancing, and training of all plumbing systems and equipment in accordance with the manufacturers’ recommendations and in conjunction with Owner’s Commissioning Verification and Testing Agent(s).

1.13 TRAFFIC SIGNAL MODERNIZATION CONTRACT (TFC) (Contract No. 5)

1.

1.14 OWNER-FURNISHED PRODUCTS

A. Owner will furnish products indicated. The Work includes providing support systems to receive Owner's equipment and making plumbing, mechanical, and electrical connections. Owner furnished products also includes existing items to be relocated by the Contractor (OFCR).

1. Owner will arrange for and deliver Shop Drawings, Product Data, and Samples to Contractor.
2. Owner will arrange and pay for delivery of Owner-furnished items according to Contractor's Construction Schedule.
3. After delivery, Owner will inspect delivered items for damage. Contractor shall be present for and assist in Owner's inspection.
4. If Owner-furnished items are damaged, defective, or missing, Owner will arrange for replacement.
5. Owner will arrange for manufacturer's field services and for delivery of manufacturer's warranties to Contractor.

6. Owner will furnish Contractor the earliest possible delivery date for Owner-furnished products. Using Owner-furnished earliest possible delivery dates, Contractor shall designate delivery dates of Owner-furnished items in Contractor's Construction Schedule.
7. Contractor shall review Shop Drawings, Product Data, and Samples and return them to Architect noting discrepancies or anticipated problems in use of product.
8. Contractor is responsible for receiving, unloading, and handling Owner-furnished items at Project site.
9. Contractor is responsible for protecting Owner-furnished items from damage during storage and handling, including damage from exposure to the elements.
10. If Owner-furnished items are damaged as a result of Contractor's operations, Contractor shall repair or replace them.
11. Contractor shall install and otherwise incorporate Owner-furnished items into the Work.

B. Owner-Furnished, Contractor Installed Products; (OFCI):
   1. Verify equipment list with Alloy5

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01.1400 – WORK RESTRICTIONS

PART 1 – GENERAL

1.1 USE OF PREMISES

A. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of site beyond areas in which the Work is indicated.

1. The work hours must comply with local township ordinance.

2. Limits: Confine constructions operations to the legal property boundaries.

3. Owner Occupancy: Owner will vacate the building and site throughout the construction period. Refer to the Phasing Drawings, which outline the general sequence of construction as it relates to the Work being conducted on property. All contractors must comply with phasing and milestone dates listed in the contract documents.

4. Perform the Work so as not to interfere with public access and adjacent public streets and residences. At all times, provide measures to ensure safe access by the Owner and the public.

5. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's representatives, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

    a. Conduct construction operations in accordance with acceptable procedure to minimize noise and dust. Fugitive dust from roadways and the site is to be reduced by means of water sprayed from a water truck or tank supplied and operated continuously by the General Contractor during construction operations.

    b. General Contractor shall be responsible for site access control, coordination and cleaning of site and public roads. The General Contractor will arrange for roadway cleaning and mechanical sweeping on a daily basis as needed and directed by the Architect

    c. Use roadways, driveways and entrances designated for construction only.

6. Comply with the requirements of municipal agencies having authority, including Federal Aviation Administration FAA and project NPDES permit requirements.

7. General Contractor shall provide protection, barriers, signage and traffic controls necessary to maintain public streets and sidewalk access and to facilitate access to temporary and permanently occupied areas during construction.

8. All contractors shall provide protection, barriers and signage for any specific scope of work under their contract that affects the public access on roads and sidewalks.

9. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

    a. Notify Owner not less than two days in advance of proposed utility interruptions.

    b. Do not proceed with utility interruptions without Owner's written permission.

10. Comply with BOROUGH tobacco use policies. In any case, smokeless tobacco use and smoking in any form is prohibited on the site and within any part of structure at any phase of construction. Smoking will be permitted only in areas designated by Owner.

11. Contractor will comply with all District regulations and policies while on District property, as well as any special regulations adopted by the Owner relating to this Project. Contractor, subcontractors and their agents and employees shall not socialize with students or faculty.

12. Inappropriate language, dress or conduct will not be tolerated on the construction site. Violations of the above shall be grounds for dismissal.

13. IDENTIFICATION: The Owner reserves the right to require all construction employees to be visually identified by the use of badges. In the event this security measure is implemented, the Owner will issue badges to all authorized employees in conjunction with the Prime Contractors and record their issuance with names, addresses, etc. Termination of employment of the construction employees will require the respective badges to be returned to the Owner for record keeping purposes. All employees must wear the badge on the job site. Employees without badges will not be permitted on the premises.

14. Contractor, subcontractors and their agents and employees, shall not be permitted in existing school facilities except in areas then currently being renovated, absent receiving prior approval from Owner or Owner's Representative.

15. Any persons violating any of the above requirements shall be subject to immediate and permanent exclusion from the BOROUGH site.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 COMPLY WITH THIS SECTION SO EXISTING OPERATIONS ARE NOT AFFECTED

A. The existing property is to be maintained in continuous operation during the entire construction period. Work is to be scheduled and conducted by each contractor such that work will not impede vehicular traffic and activities, create potential hazards to existing facilities or persons at the site or cause dust, odor, noise or other nuisances. In performing the Work all contractors shall plan their work to meet operating requirements and schedule any additional requirements outlined in this section to avoid interruption to any School operations.

B. Each Contractor has the option of providing additional temporary facilities that can eliminate a constraint in the Phasing and Milestones provided it is done without cost to the Owner and provided it does not require any other prime contractor to perform additional work and provided that all of the requirements of these specifications are met. At all times the Work must be completed in a sequence and fashion approved by the Owner. In the event of any delay in the Work that will impact the relocation or moving of furnishings or equipment, the Owner has the discretion to adjust its move or relocation milestone schedule by up to 30 days. Such action by the Owner shall be issued in writing to the contractor not less than 30 days prior to the anticipated milestone date.

C. Each contractor shall have on hand and in close proximity to the work, all tools, equipment and materials both temporary and permanent, to complete each work category without interruption. Prefabrication of assemblies shall be completed to the greatest degree possible prior to any building system shutdown to minimize the duration of the shutdown.

D. Electrical service and data service and telephone service to all operating areas is to remain in service during the construction period. Temporary shut-downs to tie in new services and systems are to be completed outside of normal operating hours and at times that are convenient to the Owner. The Electrical Contractor shall lock out and tag circuit breakers and switches and shall check cables and wires to ensure they are deenergized to ground potential before work begins.

E. All cutting and demolition work that creates noise levels in excess of 50dBA for adjacent occupied areas shall be performed after school hours, holidays or on weekends unless prior permission from the Owner has been obtained.

F. All utility interruptions shall be scheduled and shall be performed after school hours, holidays or weekends unless prior permission from the Owner has been obtained.

END OF SECTION 01.1400

SECTION 011500 - FIELD ENGINEERING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes general procedural requirements governing execution of field engineering services including, but not limited to, the following:

1. Construction layout;

2. Field surveying and recording of all underground utilities and stormwater;

B. All work specified in this Section shall be provided and paid for by the General Contractor (GC) as noted below:

1.2 SUBMITTALS

A. Qualification Data: For land surveyor to demonstrate their capabilities and experience, include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

B. Certified As-Built Underground Utilities Surveys: Submit two (2) copies signed, sealed and dated by land surveyor. Certified surveys shall be provided on reproducible mylars and on electronic files in format as directed by the Architect.

1.3 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally licensed qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.

2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

3. Information and data reflected in the Contract Documents with respect to Underground Facilities at or contiguous to the site is based upon information and data furnished to Owner and Architect by owners of such Underground Facilities or others. Owner, Construction Manager and Architect do not assume responsibility for the accuracy or completeness thereof unless it is expressly provided otherwise in the General Conditions. Contractor shall verify the location of all underground utilities prior to any excavation.

4. GC is responsible, on behalf of the project facility owner, for providing the physical markings of all existing utilities including those on site as indicated on the drawings or that may be identified in the field. The locations shown on the drawings are approximate. The Contractor must include in his bid the cost for hand-dug test holes, or other means, to ascertain the precise position of such underground facilities on the site owned by the Owner. This verification should be performed for any utilities to be relocated, removed, modified or that may otherwise interfere with planned work. The utilities in the public right of way will be identified and marked by the appropriate facility owner as per the requirements of the PA One Call Act as amended. Physical layout is to be performed in full compliance with the PA One Call PA Act 287 of 1974 as amended by Act 18 of 1996.

3.2 CONSTRUCTION LAYOUT

A. General: The GC will be responsible to layout building foundations and column grid locations.

3.3 FIELD SURVEYING

A. Identification: Owner will identify existing benchmark and control point.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

C. Layout for GC: GC shall be responsible for layout and location of all work under the General Contract.

D. Layout for other Trades: GC shall locate on-site control points, elevation control and reference points for use by MEP Trades to perform their own layout and work.

3.4 UNDERGROUND UTILITIES SURVEY

A. The Land Surveyor shall record the location, inverts, etc. of all the following underground utilities, beyond the exterior face of the building:

1. Storm Water: Include all inverts, top of rim or grate, pipe sizes and locations.

2. Storm Water Structures: Include elevations of all top of grate, bottom of structures, and pipe sizes.

3. Underground Drainage System: Include inverts, top of rim or grate and locations.

4. Underground electric, telephone, cable television, manholes, power and control lines, spare conduits for future uses, computer conduits, etc. Provide locations and elevations.

5. Sanitary Sewer System Including All Structures: Provide locations, inverts, top of rim or grate, and bottom of structures.

6. Water distribution system, electric, telephone and cable television lines shall be located at 50-foot intervals and at changes in horizontal and vertical direction of line. Around turns, where the radius is less than 100 feet, the interval shall be 25 feet.

7. Natural gas system distribution piping, piping sizes, locations and elevations.

B. The Land Surveyor shall coordinate obtaining all the above improvements information with the Contractor making the installation since trenches for utilities will be backfilled as soon as the lines are installed.

C. Contractor shall prepare all drawings necessary to record the specified information. Drawings shall indicate all property lines, new and existing structures, etc.

3.5 CONTROL POINTS

A. GC shall provide engineering and layout for his work. In addition, the GC shall provide and maintain throughout the project, building corners and column centerlines. GC shall provide floor control lines for each floor consisting of at least two perpendicular column lines per area and finish floor elevations. Each Prime Contractor shall be responsible for other surveys, engineering, layouts, etc., required in connection with their own work. The Prime Contractor, at his own expense, is to provide stakes, templates, and labor required in laying out his work as is responsible for proper execution of the Work in accord with lines, levels, elevations and dimensions indicated in the Contract Documents.

B. Contractor shall be responsible for checking the position of the reference points comprising the primary control prior to starting site work and shall notify Engineer of discrepancies found between actual and record measurements.

C. The existing reference points shall not be disturbed without prior written approval from the Engineer. If existing reference points are disturbed during construction, new reference points shall be installed by the GC to control the work. The locations of the new reference points will be approved by the Engineer prior to setting the new reference points.

D. Protection of monuments and stakes is the responsibility of GC. Replacement of damaged control and reference points shall be at Contractor's expense.

E. From the primary reference control provided by Owner, establish secondary control points necessary for the layout and construction of the Work. Secondary control shall consist of sufficient permanent points to establish the lines and grades for the various Work either directly or by offset. Layout lines for use in construction of the Work shall be established by the Contractor and taken directly from either the primary or secondary controls.

F. Secondary control shall be tied to and closed upon the primary control.

G. ACCURACY OF LAND BASED SURVEYS

1. Points for cross sections shall be located to the nearest 0.05 foot horizontally and vertically.
2. Vertical elevation surveys shall close within 0.05 foot times the square root of the length of the circuit in miles.
3. All grade stakes shall be set to 0.02 foot.
4. Alignment of tangents and curves shall be within 0.01 foot.
5. Points for structures shall be set to the nearest 0.02 foot, except where operational function of special features require closer tolerances.
6. Survey movement monuments shall be surveyed within an accuracy of 0.91 foot vertical and 0.01 foot horizontal.
7. Tolerances for all other Work shall be as shown or specified in the Contract Documents.
8. Survey instruments shall be accurate and shall be subject to inspection by Engineer for proper operation.
9. Electronic distance measuring (EDM) instruments used by Contractor on the Site shall be checked for calibration a minimum of once per month on an established base line approved by Engineer. Calibration results shall be kept in a log book, available for Engineer's review, showing the date and distances measured on the base line. An EDM shall not be used if it does not meet the minimum advertised accuracy published by the manufacturer of the EDM.
10. Defective instruments shall be promptly replaced, repaired, or adjusted to operate within the tolerances of the instrument manufacturer.
11. All work not performed with the methods and equipment as submitted by Contractor and accepted by Engineer shall be removed and replaced by Contractor at its own expense.

H. GC shall submit an electronic copy and a mylar copy of a registered site drawing prepared by a registered surveyor within 14 days of Substantial Completion and certificate signed by the Land Surveyor that elevations and locations of Work are in conformance with the Contract Documents.
1. Property lines with metes and bounds.
2. North arrow.
3. Dimensions (overall) of structures.
4. Location of structures in relation to property lines.
5. Location and dimension of setbacks, easements and rights-of-way.
6. Location of structures, wooded areas, water courses, rock outcrops, culverts and other significant physical features on the site.
7. Name of Owners of the adjoining properties. Provide information on adjoining properties as required by the Township/Borough Ordinance, including, but not limited to lot number, plat name, recording reference number, etc.
8. Utility data as follows:

a. Location of utility lines and structures, including, but not limited to electricity, gas, water, sanitary, telephone, cable and fiber cable.
b. Location and identification of storm sanitary structures, including, but not limited to manholes, cleanouts, inlets, catch basins, yard drains and endwalls. Include elevations at top and invert of each structure.
c. Location, size, type and invert of pipes flowing into and from each storm and sanitary structure.

9. Locations and trunk diameters of existing trees and tree masses located within the project site.
10. Topographic contours with two-foot intervals for overall site plan.
11. Driveway and parking areas, sidewalks, and stairs, ball fields (indicating limits of infields), running tracks, bleachers and other physical features (e.g. lighting standards, fencing, benches, paving types (concrete, bituminous, brick) curb types (concrete bituminous), etc.).
12. Elevations at perimeter of buildings, sidewalks, areaways, curbs finish floor elevations at each entry of each building and other site elements. Provide sufficient spot elevations to indicate drainage patters and vertical elevation changes (e.g. stairs, loading docks, etc.). Provide floor elevations inside building.
13. Names, dimensions and rights-of-way of adjoining streets at intersecting driveways and streets along and within 100 feet of the property frontage.
14. Utilize the same benchmark as the original survey. A copy of which was provided for information at the onset of the project.
15. Final drawing survey to be submitted electronically on a compact disk, either DXF or AutoCAD DWG format, or via e-mail.

END OF SECTION

SECTION 012100 - ALLOWANCES

Revise this Section by deleting and inserting text to meet Project-specific requirements.

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

B. Types of allowances include the following:

Revise to include on those types of allowances that are applicable to the Project.

1. Lump-sum allowances.
2. Unit-cost allowances.
3. Quantity allowances.
4. Contingency allowances.

C. Related Requirements:

1. Section 012200 – UNIT PRICES for procedures for using unit prices, including adjustment of quantity allowances when applicable.
2. Section 012600 - CONTRACT MODIFICATION PROCEDURES for procedures for submitting and handling Change Orders.

1.2 DEFINITIONS

A. Allowance: A quantity of work or dollar amount included in the Contract, established in lieu of additional requirements, used to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

1.3 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection, or purchase and delivery, of each product or system described by an allowance must be completed by the Owner to avoid delaying the Work.

B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

1.4 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances in the form specified for Change Orders.

1.5 INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.6 LUMP-SUM ALLOWANCES

Revise to suit Project.

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.7 UNIT-COST ALLOWANCES

Revise to suit Project.

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.8 QUANTITY ALLOWANCES

Revise to suit Project.

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.9 CONTINGENCY ALLOWANCES

Retain this article for contingency allowances.

A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.

B. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.

C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit.

D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

1.10 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-

place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, required maintenance materials, and similar margins.

1. Include installation costs in purchase amount only where indicated as part of the allowance.
2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other markups.

Delete both subparagraphs below if not using unit-cost allowances.

3. Submit substantiation of a change in scope of Work, if any, claimed in Change Orders related to unit-cost allowances.

Subparagraph below reflects the major drawback of using unit-cost allowances. No matter who performs the Work, a final quantity survey is needed.

4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. Allowances are outlined on Bid Forms sections 004116 – GENERAL CONSTRUCTION BID FORM, 004117 – MECHANICAL CONSTRUCTION BID FORM, 004118 – PLUMBING CONSTRUCTION BID FORM, and 004119 – ELECTRICAL CONSTRUCTION BID FORM.

END OF SECTION

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Requirements:

1. Section 012100 - ALLOWANCES for procedures for using unit prices to adjust quantity allowances.
2. Section 012600 - CONTRACT MODIFICATION PROCEDURES for procedures for submitting and handling Change Orders.

1.2 DEFINITIONS

A. Unit price is an amount incorporated into the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.3 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: The Architect will verify units of measurement with the Contractor. See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Prices are outlined on Bid Forms sections 004116 – GENERAL CONSTRUCTION BID FORM, 004117 – MECHANICAL CONSTRUCTION BID FORM, 004118 – PLUMBING CONSTRUCTION BID FORM, 004119 – ELECTRICAL CONSTRUCTION BID FORM, and 004120 TRAFFIC SIGNAL MODERNIZATION BID FORM.

END OF SECTION

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include, as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation, whether or not indicated as part of alternate.
2. Include as part of each alternate related coordination, modifications or adjustments to Work incidental to or required for a complete installation whether or not mentioned as part of the Alternate.

B. Notification: Immediately following the award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate whether alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

C. Execute accepted alternates under the same conditions as other Work of the Contract including project schedule, milestones and phases required for completion of the work.

D. Schedule: Specification sections and drawings contain requirements for materials and systems necessary to achieve the Work described under each alternate. Contract Bid Form will identify each Alternate in a format such as: 1, 2, etc..

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternates are outlined on Bid Forms sections 004116 – GENERAL CONSTRUCTION BID FORM, 004117 – MECHANICAL CONSTRUCTION BID FORM, 004118 – PLUMBING CONSTRUCTION BID FORM, and 004119 – ELECTRICAL CONSTRUCTION BID FORM.

END OF SECTION

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

B. Related Requirements:

1. Section 012500 - SUBSTITUTION PROCEDURES for administrative procedures for handling requests for substitutions made after the Contract award.
2. Section 013100 - PROJECT MANAGEMENT AND COORDINATION for requirements for forms for contract modifications provided as part of web-based Project management software.

1.2 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710.

1.3 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue, on AIA Document G709, a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request after receipt of Proposal Request, Contractor shall submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor and supervision directly attributable to the change.
    d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
    e. Quotation Form: Use forms acceptable to Architect.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 – SUBSTITUTION PRCEDURES if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use form acceptable to Architect.

1.4 ADMINISTRATIVE CHANGE ORDERS

A. Allowance Adjustment: See Section 012100 – ALLOWANCES for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.

B. Unit-Price Adjustment: See Section 012200 – UNIT PRICES for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.5 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Change Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01.2900 – PAYMENT PROCEDURES

PART 1 – GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Sections include the following:

1. Division 01 Section "Unit Prices" for administrative requirements governing use of unit prices.
2. Division 01 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.

1.2 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.3 SCHEDULE OF VALVES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
    a. Application for Payment forms with Continuation Sheets.
    b. Submittals Schedule.
2. Submit the Schedule of Values to the Architect at earliest possible date but no later than 14 days after the notice to proceed.

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the Schedule of Values:
    a. Project name and location.
    b. Name of Architect.
    c. Architect's project number.
    d. Contractor's name and address.
    e. Date of submittal.
2. Prepare Schedule of Values to clearly separate the work for each phase of the project scheduled to be occupied by the Owner.
3. Prepare Schedule of Values in compliance with costs loaded CPM schedule unless otherwise approved by Architect.
4. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
    a. Related Specification Section or Division and in compliance with cost loaded schedule.
    b. Description of the Work.

c. Name of subcontractor.
d. Name of manufacturer or fabricator.
e. Name of supplier.
f. Change Orders (numbers) that affect value.
g. Dollar value.
i. Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

5. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
6. Round amounts to nearest whole dollar total shall equal the Contract Sum.
7. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
a. Differentiate between items stored on-site and items stored off-site. Include evidence of insurance or bonded warehousing if required.
8. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
9. Allowances: Provide a separate line item in the Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
10. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.
b. Mechanical, Plumbing and Electrical Contractors shall include a separate Schedule of Values line item for coordination drawings.
11. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.4 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for submission of each application for payment is the 1st day of each month. There are to be no projections. The period covered by each Application for Payment ends on the FINAL day of each month. Pencil copies of applications for payment shall be submitted in advance for review by Architect, and Owner no later than the 20th day of each month. All payment applications must comply with project scheduling requirements. These dates are subject to change for the duration of the Project by the Owner prior to the first application for payment.

C. Payment Application Forms: Use AIA Documents as form for Applications for Payment. Provide certification signature lines for the Architect. Utilize AIA G702-1992.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
    1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
    2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Transmittal: Submit four (4) signed and notarized original copies of each Application for Payment to the Architect by a method ensuring receipt within 24 hours.
    1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

F. Initial Application for Payment: The following minimum administrative actions and submittals must precede the submittal of first Application for Payment:
    1. List of subcontractors.
    2. Schedule of Values.
    3. Contractor's CPM Construction Schedule (preliminary if not final).
    4. Products list.
    5. Schedule of unit prices.
    6. Submittals Schedule (preliminary if not final).
    7. List of Contractor's staff assignments.
    8. List of Contractor's principal consultants.
    9. Copies of building permits.
    10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
    11. Initial progress report.
    12. Report of pre-construction conferences.
    13. Initial settlement survey and damage report if required.
    14. Construction Waste Management Plan.
    15. Construction IAQ Management Plan (preliminary if not final).

        The first payment application will not be processed unless these, and any other items required by the Architect, are processed.

G. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

    1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
    2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
    3. Provide any other documentation including warranties, manuals or other information requested by Architect.

H. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
    1. Evidence of completion of Project closeout requirements.

2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. AIA Document G707A, "Consent of Surety to Reduction in or Partial Release of Retainage."
8. Evidence that claims have been settled.
9. Final, liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01.2900

SECTION 012901 - PAYMENT PROCEDURES FOR ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

B. Division 32 Specification Section 321216 “Asphalt Paving”.

1.2 ASPHALT PAVING PRICING

A. The Base Bid contract sum shall be adjusted for asphalt paving based upon changes from the PennDOT Asphalt Cement Price Index for PennDOT Zone 1, District 6 that is in effect on a per ton basis on the date when the bids are due in accordance with the following formula:

1. Price Adjustment Criteria and Conditions: The following criteria and conditions will be considered in determining a price adjustment for bituminous materials:

a. No Price Adjustment: When the ratio IP/IB falls within the range of 0.90 to 1.10 no price adjustment will be made for any bituminous material placed during the relevant month.

b. Price Rebate: When the ratio IP/IB is calculated to be less than 0.90, the Borough will receive an automatic price rebate determined according to the following formula:

P.R. = (0.90 – IP/IB) (Q) (IB); where:

P.R. = Price Rebate

IP = Price Index for the last Wednesday for the month preceding the month in which the material is placed (One-Month Price Adjustment Period)

IB = Price Index in effect when the bids are due

Q = Quantity in tons of Asphalt in Mixture placed

c. Price Increase: When the ratio IP/IB is calculated to be greater than 1.10, the Contractor will receive a price increase determined according to the following formula:

P.I. = (IP/IB – 1.10) (Q) (IB); where:

P.I. = Price Increase

IP = Price Index for the last Wednesday for the month preceding the month in which the material is placed (One-Month Price Adjustment Period)

IB = Price Index in effect when the bids are due

Q = Quantity in tons of Asphalt in Mixture placed

B. Contractor shall submit daily weight tickets and shall submit plant material certificates identifying Bitumen in mixture placed.

C. Contractor shall submit monthly calculation based on above formula for verification and final approval by Borough Civil engineer and Architect.

D. Final price adjustment will be made by change order or allowance adjustment as determined by Owner based on the actual price adjustment verification by Borough Civil engineer and Architect.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012901

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project, including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. RFIs.
4. Digital project management procedures.
5. Web-based Project management software package.
6. Project meetings.

B. Each prime contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

C. Related Requirements:

1. Section 011200 - MULTIPLE CONTRACT SUMMARY for a description of the division of work among separate contracts and responsibility for coordination activities not in this Section.
2. Section 013200 - CONSTRUCTION PROGRESS DOCUMENTATION for preparing and submitting Contractor's construction schedule.
3. Section 017300 - EXECUTION for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
4. Section 017700 - CLOSEOUT PROCEDURES for coordinating closeout of the Contract.
5. Section 019113 - GENERAL COMMISSIONING REQUIREMENTS for coordinating the Work with Owner's Commissioning Authority.

1.2 DEFINITIONS

A. BIM: Building Information Modeling.

B. RFI: Request for Information. Request from Contractor seeking information required by or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses, cellular telephone numbers, and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in Project meeting room, in temporary field office, in web-based Project software directory, and in prominent location in each built facility. Keep list current at all times.

1.4 GENERAL COORDINATION PROCEDURES

A. Coordination of Multiple Contracts: Each contractor shall cooperate with Project coordinator, who shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its own operations with operations included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results, where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and direction of Project coordinator to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work.

E. Each Contractor shall:

1. Perform his Work as mandated by the project schedule to maintain the required sequence and the overall progress of the project.
2. Coordinate Work of his own employees and subcontractors.
3. Expedite his Work to assure compliance with approved schedules.
4. Coordinate his Work with that of other Prime Contractors and work by the Owner.

F. Modifications to the Work made necessary by a Contractor's failure to properly coordinate the Work, shall be made by that Contractor, at no cost to the Owner.

G. Remove Work installed out of sequence that prohibits a separate Prime Contractor the ability to install Work that is dependent on their prior installation of materials or equipment. No additional compensation or time extension will be considered for the uncovering or removal of the out of sequence Work.

H. Each Prime Contractor shall coordinate space requirements and installation of mechanical and electrical work indicated diagrammatically on the Contract Drawings. Follow routing shown for pipes, ducts and conduit as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance and for repairs.

I. Where availability of space is limited, each Prime Contractor shall coordinate installation of different components with other Prime Contractors to assure maximum accessibility for required maintenance, service and repair and to meet governing code requirements.

J. Each Prime Contractor shall make adequate provisions to accommodate items scheduled for later installation.

K. Each Prime Contractor shall, in finished areas except as otherwise indicated, conceal pipes, ducts and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements provided by other Contractors.

L. Each Prime Contractor shall verify utility requirement characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

M. Each Prime Contractor shall coordinate Testing and Inspection Services:

1. Verify required laboratory personnel are present.
2. Verify tests are made in accord with specified standards.
3. Review test reports for compliance with specified standards.
4. Recommend and administer any required retesting.
5. Submit copies to the Owner and Architect/Engineer.

6. Coordinate with Owner's Geotechnical Engineer for compaction and moisture content testing. Notify Geotechnical Engineer in advance of need for testing in accord with Project Construction Schedule.
7. Coordinate with Owner's Inspection Agency for concrete, masonry and steel testing and inspection. Notify agency in advance when testing and inspection is required.

N. Each Prime Contractor shall coordinate completion and clean-up of Work of separate sections in preparation for Substantial Completion, and for portions of Work designated for Owner's partial occupancy.

O. Each Prime Contractor shall, after Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accord with Contract Documents, to minimize disruption of Owner's activities.

P. In addition to its project superintendent, each Prime Contractor shall provide other administrative and supervisory personnel required for proper performance of Work, including special personnel required for coordination of operations with other Prime Contractors.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

    a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
    b. Coordinate the addition of trade-specific information to coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
    c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
    e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
    f. Indicate required installation sequences.
    g. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

2. Coordination Process: Develop coordination drawings in a logical sequence that supports the construction schedule and construction phasing. Coordinate work sufficiently in advance of installation to identify and resolve conflicts before affected Work is fabricated or installed.

    a. Where Building Information Modeling or other digital coordination methods are required or used for the Project, use such methods as a coordination aid to identify, communicate, and resolve spatial conflicts among the Work of multiple entities.
    b. Coordinate trade-specific information progressively as design information, Shop Drawings, Product Data, and other required information become available. Interim or partially completed coordination drawings may be submitted when necessary to maintain the construction schedule, provided incomplete information is clearly identified and subsequently incorporated when available.
    c. Each Contractor shall review its Work against the Work of other affected Contractors and identify conflicts, interferences, access requirements, and installation sequence issues requiring resolution.
    d. Make every reasonable effort to retain the layouts, locations, dimensions, and routings indicated in the Contract Documents. Coordination drawings shall not be used to redesign the Project or to authorize changes to the Contract Documents.
    e. Minor adjustments to routing or location of concealed Work may be made when necessary to resolve coordination conflicts, provided such adjustments do not alter the design intent, function, required clearances, exposed conditions, architectural appearance, or requirements of the Contract Documents.
    f. Do not change wall or chase locations, ceiling heights, door swings or locations, windows or other openings, exposed equipment locations, sizes of systems or components, or other architectural, structural, functional, or aesthetic features through the coordination process without appropriate direction or approval in accordance with the Contract Documents.
    g. Conflicts or interferences that cannot be resolved without modifying the Contract Documents shall be identified and submitted to the Architect through an RFI in accordance with this Section. Do not proceed with a proposed modification to the Contract Documents based solely on information shown in coordination drawings or digital models.

3. Coordination Meetings: Participate in coordination meetings and other coordination activities scheduled as necessary to support the construction schedule. Provide representatives familiar with the Work and authorized to address coordination issues. Review current and upcoming coordination areas, conflicts, required information, installation sequencing, and actions necessary to maintain progress.
4. Coordination Schedule: Coordinate preparation and submission of coordination drawings with the Contractor's construction schedule and applicable project phasing. Provide coordination drawings sufficiently in advance of fabrication and installation to permit review, conflict resolution, and incorporation of required information without delaying the Work.
5. Updates During Construction: Revise coordination drawings when changes to the coordinated Work occur as a result of approved changes, Shop Drawing review, RFIs, field conditions, or other authorized modifications. Distribute revised information to affected parties as necessary to maintain coordination of subsequent Work.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling, raised access floor, and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms, showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:

    a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
    b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
    c. Fire-rated enclosures around ductwork.
    d. Refer to Division 23 Section - BASIC MECHANICAL MATERIALS AND METHODS and for specific Coordination Drawing requirements for mechanical installations.

7. Electrical Work: Show the following:

    a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
    b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
    c. Panel board, switchboard, switchgear, transformer, busway, generator, and motor-control center locations.
    d. Location of pull boxes and junction boxes, dimensioned from column center lines.
    e. Refer to Division 23 Section - BASIC ELECTRICAL MATERIALS AND METHODS for specific Coordination Drawing requirements for electrical installations.

8. Fire-Protection System: Show the following:

    a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

9. Review: Architect will review coordination drawings to confirm that, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. Architect's review does not relieve Contractor of responsibility for coordination of the Work or for compliance with the Contract Documents. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.
10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 013300 - SUBMITTAL PROCEDURES.

C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:

1. File Preparation Format:

   a. Same digital data software program, version, and operating system as original Drawings.
   b. DWG, Version 2018, operating in Microsoft Windows operating system.

2. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format and PDF format.
3. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.

   a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
   b. Digital Data Software Program: Drawings are available in Autodesk REVIT 2026.
   c. Contractor shall execute a data licensing agreement in the Agreement form as provided by Architect.

4. Coordination Model Updates: Where a project BIM or digital coordination model is established, incorporate applicable coordination information and authorized changes into the model in accordance with the Project's digital coordination requirements. Maintain coordination information sufficiently current to support ongoing coordination and construction.
5. Data Licensing: Where Architect-furnished digital data or Building Information Modeling files are subject to a data licensing agreement, execute the applicable agreement before receiving or using the files.

1.6 REQUEST FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
2. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Owner name.
3. Owner's Project number.
4. Name of Architect.
5. Architect's Project number.
6. Date.
7. Name of Contractor.
8. RFI number, numbered sequentially.

9. RFI subject.
10. Specification Section number and title and related paragraphs, as appropriate.
11. Drawing number and detail references, as appropriate.
12. Field dimensions and conditions, as appropriate.
13. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
14. Contractor's signature.
15. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.

    1. Attachments shall be electronic files in PDF format.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

    1. The following Contractor-generated RFIs will be returned without action:

        a. Requests for approval of submittals.
        b. Requests for approval of substitutions.
        c. Requests for approval of Contractor's means and methods.
        d. Requests for coordination information already indicated in the Contract Documents.
        e. Requests for adjustments in the Contract Time or the Contract Sum.
        f. Requests for interpretation of Architect's actions on submittals.
        g. Incomplete RFIs or inaccurately prepared RFIs.

    2. Architect's action may include a request for additional information or clarification, in which case Architect's time for response will date from time of receipt by Architect of additional information.
    3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 - CONTRACT MODIFICATION PROCEDURES.

        a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 5 days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use software log that is part of web-based Project management software. Software log with not less than the following:

    1. Project name.
    2. Name and address of Contractor.
    3. Name and address of Architect.

4. RFI number, including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within 3 days if Contractor disagrees with response.

1.7 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Web-Based Project Management Software Package: Project Coordinator shall provide, administer, and use web-based Project management software package for purposes of hosting and managing Project communication and documentation until Final Completion.

1. Web-based Project management software includes, at a minimum, the following features:

   a. Compilation of Project data, including Contractor, subcontractors, Architect, Architect's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
   b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
   c. Document workflow planning, allowing customization of workflow between project entities.
   d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
   e. Track status of each Project communication in real time, and log time and date when responses are provided.
   f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
   g. Processing and tracking of payment applications.
   h. Processing and tracking of contract modifications.
   i. Creating and distributing meeting minutes.
   j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
   k. Management of construction progress photographs.
   l. Mobile device compatibility, including smartphones and tablets.

2. Provide up to twelve Project management software user licenses for use of all Prime Contractors, Owner, Architect, and Architect's consultants.
3. The software shall include online technical assistance all licensed Users throughout the life of the project.
4. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Architect. Provide data in locked format to prevent further changes.

5. The Project Coordinator shall provide one of the following Web-based Project Management Software Packages:
    a. Projectmates by Octave.
    b. ProjectSight by Trimble, Inc.
    c. Procore by Procore Technologies, Inc.

B. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:

1. Assemble complete submittal package into a single indexed file, incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.8 PROJECT MEETINGS

A. General: Project Coordinator will schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times a minimum of seven days prior to meeting.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Project Coordinator will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

1. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:

    a. Responsibilities and personnel assignments.
    b. Tentative construction schedule.
    c. Phasing.
    d. Critical work sequencing and long lead items.
    e. Designation of key personnel and their duties.
    f. Lines of communications.
    g. Use of web-based Project software.
    h. Procedures for processing field decisions and Change Orders.
    i. Procedures for RFIs.
    j. Procedures for testing and inspecting.

k. Procedures for processing Applications for Payment.
l. Distribution of the Contract Documents.
m. Submittal procedures.
n. Preparation of Record Documents.
o. Use of the premises and existing building if applicable.
p. Work restrictions.
q. Working hours.
r. Owner's occupancy requirements.
s. Responsibility for temporary facilities and controls.
t. Procedures for moisture and mold control.
u. Procedures for disruptions and shutdowns.
v. Construction waste management and recycling.
w. Parking availability.
x. Office, work, and storage areas.
y. Equipment deliveries and priorities.
z. First aid.
aa. Security.
bb. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other Sections and when required for coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

a. Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Review of mockups.
i. Possible conflicts.
j. Compatibility requirements.
k. Time schedules.
l. Weather limitations.
m. Manufacturer's written instructions.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.

r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.
u. Installation procedures.
v. Coordination with other work.
w. Required performance results.
x. Protection of adjacent work.
y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Project Coordinator will schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

a. Preparation of Record Documents.
b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
c. Procedures for completing and archiving web-based Project software site data files.
d. Submittal of written warranties.
e. Requirements for preparing operations and maintenance data.
f. Requirements for delivery of material samples, attic stock, and spare parts.
g. Requirements for demonstration and training.
h. Preparation of Contractor's punch list.
i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
j. Submittal procedures.
k. Coordination of separate contracts.
l. Owner's partial occupancy requirements.
m. Installation of Owner's furniture, fixtures, and equipment.
n. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Project Coordinator will conduct progress meetings at biweekly intervals.

1. Project Coordinator shall establish the recurring dates of meetings in collaboration with Owner and Architect at the Preconstruction Meeting.
2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

    a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

        1) Review schedule for next period.

    b. Review present and future needs of each entity present, including the following:

        1) Interface requirements.
        2) Sequence of operations.
        3) Status of submittals.
        4) Deliveries.
        5) Off-site fabrication.
        6) Access.
        7) Site use.
        8) Temporary facilities and controls.
        9) Progress cleaning.
        10) Quality and work standards.
        11) Status of correction of deficient items.
        12) Field observations.
        13) Status of RFIs.
        14) Status of Proposal Requests.
        15) Pending changes.
        16) Status of Change Orders.
        17) Pending claims and disputes.
        18) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

    a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

F. Coordination Meetings: Project Coordinator will conduct Project coordination meetings at weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: In addition to representatives of Owner and each Prime Contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review schedule and work planned for the next two weeks. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

    a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.

        1) At each coordination meeting, each Prime Contractor is to provide a written two-week look ahead schedule to the General Contractor for review and comment.

    c. Review present and future needs of each contractor present, including the following:

        1) Interface requirements.
        2) Sequence of operations.
        3) Status of submittals.
        4) Deliveries.
        5) Off-site fabrication.
        6) Access.
        7) Site use.
        8) Temporary facilities and controls.
        9) Work hours.
        10) Hazards and risks.
        11) Progress cleaning.
        12) Quality and work standards.
        13) Status of RFIs.
        14) Proposal Requests.
        15) Change Orders.
        16) Pending changes.
        17) Special Inspections.
        18) Inspections.

3. Reporting: Project Coordinator shall record meeting results and distribute copies within two days of the meeting to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 013117 - COORDINATION DRAWINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section and each Division 01 Section applies to all separate Prime Contracts.

B. This Section includes requirements for preparation of Coordination Drawings for structural, mechanical, plumbing, fire protection, and electrical work.

C. Related Requirements:

1. Section 011500 – FIELD ENGINEERING.

2. Section 013300 – SUBMITTAL PROCEDURES.

3. Section 013100 – PROJECT MANAGEMENT AND COORDINATION and Section 011200 – MULTIPLE CONTRACT SUMMARY specify requirements for coordinating construction operations by the Prime Contractors.

1.3 DEFINITIONS

A. Coordination Drawings: Scaled drawings and Building Information Modeling files (BIM) prepared by each Prime Contractor which superimpose work of several trades, intended for careful coordination of installation of products and materials provided by separate entities.

B. Key Drawings: Two-dimensional drawings of each floor or area of the Project indicating proposed subdivision into ductwork layout shop drawings.

C. Layout Drawings: Two- and three-dimensional architectural and structural backgrounds to be used by all Prime Contractors for development of Coordination Drawings.

D. Electronic Documents: Electronic reproductions and photocopy reproductions of Contract Drawings will not be accepted for shop drawing and product submittals by contractors. Refer to procedures for obtaining Contract Drawings for background use only and BIM Model for coordination purposes only. The Construction Documents and BIM Model shall not be construed as dictating the means and methods of construction.

1.4 COORDINATION DIGITAL DATA FILES

A. Prepare coordination digital data files according to the following requirements:

1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings (Revit 2024) operating in Microsoft Windows operating system.

2. File Submittal Format: Submit or post coordination drawing files using Portable Document Format (PDF) and Navisworks File (NWC).

3. Architect and their consultants will furnish Contractor one set of Revit 2024 Building Information Modeling files (BIM) of Drawings for use in preparing coordination digital data files.

a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.

b. Digital Data Software Program: Drawings are available in Revit 2024 digital data software working on the Windows operating system. Sheet views will be deleted to protect Architect and consultants. Full model will be available for coordination.

c. Contractor shall execute Section 013117B – 3D COMPUTER MODEL AGREEMENT, and additional releases that may be provided by the Architect, prior to the transfer of files to the Contractor.

4. BIM File Incorporation: Develop and incorporate coordination drawing information into Building Information Model established for Project.

a. Each of the Prime Contractors shall model their respective systems in the BIM Model that are part of their contract and provide updated files to the HVAC Contractor.

b. The HVAC Contractor (Prime Coordinator) shall perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts with each Prime prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect and obtain approval of Architect.

c. HVAC Contractor shall revise the BIM model as necessary to reflect the coordination changes. HVAC Contractor shall pay for the cost of revisions to the BIM model. HVAC Contractor shall include a separate minimum of 300 hours for specific changes to Architectural components of the BIM model provided by Architect as a result of supplemental instruction or other direction that is identified as a result of coordination. All modifications, enhancements, additions, and changes to structural, mechanical, electrical, plumbing, fire protection, or HVAC components shall be made by the respective Prime Contractors responsible for that system as part of their contract.

1.5 COORDINATION DRAWING PROCEDURES

A. General: Approval of Shop Drawings assumes satisfactory incorporation of coordination information.

B. Do not use Contract Drawings as Coordination Drawings.

C. Initial Submittal: Key Drawings and BIM layout drawings shall be submitted by HVAC Contractor within 60 calendar days of Contract Award.

D. Final Submittal: Submit final BIM layout drawings and Coordination Drawings 60 days after submission of Initial Submittal.

E. Provide Coordination Drawing initial submittals as follows:

1. Key Drawings: The HVAC Contractor shall prepare and submit Key Drawings consisting of scaled drawings in PDF format of each floor or area of the Project indicating proposed subdivision into ductwork layout shop drawings, with applicable shop drawing numbers.

2. Review: The HVAC Contractor shall conduct a Coordination Planning Meeting with all contractors and the Architect to review the Key Drawings and determine adequacy of proposed layouts to cover the Project and the following:

a. Sequencing and scheduling of Coordination Drawing production in relation to the Construction Schedule.

b. Complex areas for which larger scale drawings and details will be required.

c. Coordination Drawing format, text, title blocks, and Contractor coordination sign-off.

3. Layout Drawings: Upon acceptance of Key Drawings, HVAC Contractor shall prepare common BIM layout drawings of all architectural and structural backgrounds to be used by all Prime Contractors for development of Coordination Drawings. Include the following elements and information on Layout Drawings:

a. Columns and beams.

b. Ceiling heights.

c. Ceiling dimensional layouts as shown on reflected ceiling plans.

d. Acoustical ceiling grid.

e. Wall-to-wall dimensions.

f. Partition layouts.

g. Windows, doors, and other openings.

h. Other major architectural and structural features shown on General Construction Drawings.

i. Indicate dimensions from column centerlines.

j. Include space in title block for Contractor sign-off and shop drawing control number.

4. Drawing Format: Produce Layout Drawings in BIM format. The version of BIM software used to produce the layout drawings shall be at the discretion of the HVAC Contractor; however, any version used must be compatible with Revit 2024. The HVAC Contractor shall coordinate the modeling software he proposes to use with the other Prime Contractors. The HVAC Contractor shall distribute the layout drawings in BIM format to the following for their use:

a. Architect.

b. General Contractor.

c. HVAC Contractor.

d. Plumbing/Fire Protection Contractor.

e. Electrical Contractor.

f. Subcontractors as deemed appropriate by the Architect.

F. Coordination Drawing Preparation: Upon receipt of BIM Layout files, each Prime Contractor shall proceed immediately and independently to indicate the work included in their Contract:

1. Circle, highlight, or otherwise clearly indicate deviations from Contract Documents and state reasons for deviation.

2. BIM Standards: Comply with the following:

a. Indicate conduits and pipes with diameter of less than 6 inches with single lines.

b. Indicate ducts and pipes with diameter of 6 inches and greater with double lines showing width to scale.

c. Indicate busways to scale.

d. Use competent BIM operator to develop Coordination Drawings in a clear, legible manner.

e. The Owner and Architect shall have sole judgment as to acceptability of Coordination Drawings and adherence to expected standards.

3. Ductwork Drawings: Show all items included as part of ductwork system, including:

a. Ductwork with insulation.

b. Hangers.

c. Equipment.

d. Grilles, registers, and diffusers.

e. Filters.

f. Volume dampers.

g. Fire dampers.

h. Automatic control dampers.

i. Duct smoke detectors.

j. Access doors and other access requirements for maintenance.

k. Location of ATC sensors and controllers.

4. Piping Drawings: Show all items included in piping systems, including:

a. Piping runs with insulation.

b. Hangers.

c. Valves.

d. Coils.

e. Equipment.

f. Sensors.

g. Flow monitors.

h. Access door locations and other access requirements for maintenance.

5. Plumbing and Fire Suppression Drawings: Show all items included for plumbing and fire suppression systems, including:

a. All domestic water, fire suppression, rainwater, and sanitary piping including main and branch lines.

b. Standpipes.

c. Sprinkler heads.

d. Valves.

e. Fire hose cabinets.

f. Inspector test assemblies.

g. Drain outlets.

h. Access door locations and other access requirements for maintenance.

i. Flow and tamper valves.

6. Electrical Drawings: Show items included in lighting and electrical power systems, including:

a. Equipment.

b. Panels.

c. Boxes.

d. Conduit runs.

e. Light fixture locations and depths.

f. Devices.

g. Access door locations and other access requirements for maintenance.

h. Cable trays.

7. Structural Drawings: Show all foundation and structural systems, braces, hangers, and connections.

8. Other contractors required to participate in coordination drawing program shall indicate their work on the BIM Layout Drawings as directed.

9. Additional Drawings: Each contractor shall prepare additional BIM drawings as necessary to show the intended routing and layout of their work adequately and completely. Additional drawings may include riser diagrams, flow sheets, elevations, details, sections, isometric layouts, etc. as determined by the Architect or HVAC Contractor.

10. Scheduling: Time allotted for each contractor to develop their Coordination Drawings and schedule of coordination meetings will be determined by the HVAC Contractor and Project Coordinator during the initial coordination planning meeting.

    a. Each Contractor's initial planning shall include preparing and coordinating not less than four (4) drawing areas per week or a greater amount if required. Project management time required to accomplish this schedule shall be included in Bid.

    b. Each Prime Contractor shall be responsible to provide sufficient staff at appropriate times to avoid delays in the coordination process.

    c. Coordination Drawing preparation shall commence as soon as final BIM layout drawings are submitted.

11. Interim Submissions: Coordination Drawings and Building Information Modeling files (BIM) shall be developed and submitted in the sequence directed, in sufficient time to avoid delay in the construction schedule. Partially completed Coordination Drawing submissions may be accepted in cases where complete data is not available, pending receipt of shop drawings. Leave sufficient space to incorporate missing information in subsequent submission; note such omissions and state reason for vacant area.

    a. When final information is available, promptly insert in Coordination Drawings. Submit complete set of Coordination Drawings covering all areas once final information is incorporated.

G. Coordination Process: Due to the complexity of the Project, coordination activities are anticipated to be a continuous daily operation. HVAC Contractor and other Prime Contractors shall devote whatever is necessary to fulfill the requirements and to keep the process on schedule. HVAC Contractor shall revise the BIM model as necessary to reflect the coordination changes. HVAC Contractor shall pay for the cost of revisions to the BIM model.

1. Basis for Placement of Elements: Make every reasonable effort to retain the layouts, placements, and routings shown on the Contract Drawings. Deviations from Contract Drawings will be permitted only when no other resolution is deemed appropriate and only upon written approval of the Architect.

2. Coordination Drawing Development: As Coordination Drawings are developed, each Prime Contractor shall check and adjust locations to avoid interferences. Highlight conflicts, particularly involving finish products, for discussion at coordination meeting. Minor variances from Contract Drawings in routing of ducts, pipes, and conduits may be made to avoid conflicts when mutually agreed, provided these variances do not alter the intended function or require an adjustment of the Contract Sum.

    a. Do not change sizes, adjust location of exposed items, or expose items not shown exposed on Contract Drawings without approval of the Architect.

    b. Do not revise any wall or chase locations, ceiling heights, door swings or locations, windows or other openings, or other features affecting the function or aesthetic effect of the building.

    c. Refer conflicts and interferences that cannot be satisfactorily resolved to the Architect for a determination through the use of an RFI.

    d. Coordination drawings shall follow the construction phasing drawing sequence.

3. Coordination Meetings: The HVAC Contractor, in cooperation with the Project Coordinator, will schedule coordination meetings every two weeks, or as required, to review each contractor's layout drawings. All Prime Contractors, major trade contractors, and subcontractors, as required by the HVAC Contractor and Project Coordinator, shall be represented at the meetings to review and resolve conflicts and interferences.

4. Coordination Sequence:

    a. Structural detailer to complete structural model. Upon completion, in whole or by phase or area determined at the coordination meetings, this model shall be shared with the HVAC Contractor.

    b. HVAC Contractor to model all HVAC systems. HVAC Contractor to perform clash detection between HVAC, structural items, and ceiling systems. All clashes shall be resolved prior to proceeding.

    c. HVAC Contractor to provide all other Prime Contractors the coordinated Structural and HVAC models.

    d. All Prime Contractors to complete their 3D Models for their systems. Upon completion, provide model to HVAC Contractor.

    e. HVAC Contractor to combine all models and run clash detection to report all interferences. HVAC Contractor to host coordination meetings as required to resolve all interferences with respective contractors.

5. Coordination Responsibility: All Prime Contractors have collective responsibility to fulfill coordination requirements. The HVAC Contractor and Project Coordinator may require attendance at meetings on a daily or weekly basis, or as otherwise required, to maintain the Project schedule.

    a. If it becomes necessary to relocate any element due to failure of a Prime Contractor to coordinate the Work, the responsible Contractor shall bear the cost for such relocation, including costs for additional work performed by other Prime Contractors as a result of the responsible Prime Contractor's failure to properly coordinate.

    b. Responsibility for the costs for any such additional work shall be as determined by the Architect. In the event an agreement as to responsibility cannot be reached, the Architect's determination shall be made in accordance with the Conditions of the Contract.

H. Final Coordination Drawings: Once all necessary information has been added to the BIM Layout Drawings, the HVAC Contractor shall prepare a conformed file and review for clashes to be resolved. All clashes shall be addressed to create the final layout drawings and BIM Model. The HVAC Contractor (Prime Coordinator) shall perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts with each Prime prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect. Each Prime Contractor required to produce Coordination Drawings shall sign off on each of the other Coordination Drawings to indicate agreement and recognition of the indicated routing and layouts and the correlation with adjoining or contiguous work of all contracts.

1. After sign-off, no unauthorized deviations will be permitted. If deviations are made without consent of the Architect or other affected Prime Contractors, the responsible Prime Contractor shall remove and correct the affected work at no additional cost to the Owner.

2. Final Submission: Following agreement and sign-off by all Prime Contractors, the HVAC Contractor shall submit the files of all the systems to the Architect for review as follows: one (1) electronic copy (PDF) of all 2D drawings, one (1) Navisworks NWC file, and one (1) Navisworks NWF file of completed Coordination Drawings. Furnish one additional electronic copy (PDF) to all other Prime Contractors and applicable subcontractors. Furnish one (1) electronic copy (PDF), one (1) Navisworks NWC file, and one (1) Navisworks NWF file of completed Coordination Drawings to the Owner. The

files submitted shall note any conflicts or changes required that require further input or direction of Architect.

a. Architect will review for resolution of conflicts and will process Coordination Drawings for general conformance with design only.

I. Shop Drawing Coordination: Shop Drawings produced separately from Coordination Drawings shall be reviewed by the submitting Prime Contractor in detail to assure conformance with coordination process. Include a statement and signature on shop drawings indicating contractor's review and conformance with Coordination Drawings.

1. Architect's review of shop drawings submitted during the coordination process will be considered independent of Coordination Drawing review and need not take into consideration information included on Coordination Drawings.

2. If changes resulting from shop drawing review affect work included in Coordination Drawings, the Prime Contractor submitting the shop drawing shall correct the Coordination Drawing, coordinate with affected Prime Contractors, and resubmit for approval. Perform correction and coordination without delay or additional cost to avoid impacting the construction schedule.

J. Record Coordination Drawings: Each Prime Contractor shall retain record copies of final Coordination Drawings and Building Information Modeling files (BIM) as a working reference. Any revision which may become necessary during the course of the Work shall be neatly and accurately recorded on the record copies by each Prime Contractor. Each Prime Contractor is responsible for maintaining record Coordination Drawings up to date.

1. Each Prime Contractor shall maintain one copy of record Coordination Drawings available at the site.

2. All changes in the Work of any Contract, whether or not associated with a change in cost, shall be recorded on the Coordination Drawings.

3. Coordination Drawings and any subsequent changes shall be incorporated into As-Built Drawings.

a. Subject to approval of the Owner and Architect, final updated Coordination Drawings may be used for As-Built Drawings.

b. As-Built Drawings shall also incorporate details of structural elements cut during construction and supplemental bracing or reinforcement.

K. Resolution of Conflicts: Where conflicts occur either on Coordination Drawings or during actual installation in the field, and they can be resolved by rerouting conflicting elements or installing risers, offsets, falls, curves, pull boxes, transitions, or other solutions, the affected Prime Contractor shall bear the expense of adjustments required, including costs for labor and material, and shall modify the Coordination Drawings to reflect the changes at no additional cost.

L. Managing As-Built and Record BIM Model: The HVAC Contractor shall periodically coordinate with each of the Prime Contractors the updates to the BIM Model and all the systems and components. The Prime Contractors are responsible for updating their model to reflect as-built information and provide this to the HVAC Contractor for final model update. Any Prime Contractor who does not provide the revisions when requested will be subject to the assessment of costs to perform this work. The HVAC Contractor shall deliver a final and complete BIM model showing all as-built conditions at the completion of the Project to the Architect and Owner.

1.6 COORDINATION DRAWING CONTENT

A. The Prime Contractor responsible for Work in each of the following categories shall prepare or arrange for preparation of Coordination Drawings and 3D model for the following systems:

1. Kitchen equipment.

2. HVAC systems.

3. Electrical systems.
4. Plumbing systems.
5. Fire protection systems including sprinklers.
6. Openings and sleeves in structural slabs and structural framing.
7. Ceiling systems.
8. Wall systems.

B. Include on Coordination Drawings and in 3D model the information listed below for each of the following categories of Work:

1. Food Service Equipment:
    a. Locations and dimensions of food service equipment.
    b. Access panels and hatchway.
    c. Rough-in locations for mechanical and electrical services.
2. HVAC Systems:
    a. Sizes and bottom elevations of rectangular ductwork.
    b. Sizes and centerline elevations of round ductwork, piping, and conduit.
    c. Acoustical lining in ductwork.
    d. Identification of low-, medium-, and high-pressure ductwork.
    e. Locations of major components, including dampers, valves, diffusers, cleanouts, and electrical distribution equipment.
    f. HVAC and ATC panels.
3. Electrical Systems: Equipment Control Panels:
    a. Horizontal and vertical runs of conduit 1-1/4-inch diameter and larger.
    b. Light fixture location.
    c. Smoke detector locations.
    d. Speaker locations.
    e. Panelboards, switchboards, switchgear, transformers, busways, generator, and motor control center.
    f. System racks.
    g. Exit signs, strobe/horn, and emergency battery pack locations.
    h. Pull boxes dimensioned from column centerlines.
    i. Cable tray pathways.
4. Electrical Systems: Other:
    a. Lighting systems and fixtures.
    b. Power systems, conduit, and cable tray.
    c. Sound and other systems.
5. Plumbing and Fire Protection Systems:
    a. Sizes and centerline elevations of sprinkler piping.

b. Sprinkler head locations with elevations referenced to ceiling heights.

c. Locations of major valves. Test and drain ports.

d. All rainwater piping.

e. All plumbing piping including domestic water, sanitary, vent piping, and cleanout locations.

6. Structural Work:

a. Openings and sleeve locations required in slabs, walls, beams, and other structural elements, including required openings not indicated on Contract Documents.

b. Slab edge locations.

c. Columns, beams, joists, hangers, connections, braces, and other structural systems.

7. Ceiling Systems:

a. Locations in ceiling of mechanical, fire protection, and electrical items, including grilles, registers, diffusers, light fixtures, smoke detectors, sprinkler heads, exit signs, speakers, and other items.

b. Conform to locations indicated on Contract Drawings to the maximum extent possible.

c. Indicate positions relative to acoustical ceiling grid where applicable.

8. Wall Systems: All walls, chases, and other components.

9. Stage Equipment.

1.7 BIM MODELING CONTENT

A. See the attached summary from AIA Document G202-2013, Project BIM Protocol Form, included as Section 013117C, that identifies the minimum expected Level of Development that contractors are responsible to address and incorporate.

1.8 STRICT COMPLIANCE WITH COORDINATION REQUIREMENTS

A. Each Prime Contractor recognizes that they must cooperate and coordinate all of their work. Any Prime Contractor that does not comply with the established timelines and requirements for coordination will have their payment request withheld until the necessary work is completed. In addition, the Prime Contractor may be charged the costs for doing any coordination drawing or BIM Modeling that is part of their contract responsibility.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013117A

DRAFT AIA® Document G203™ – 2022

BIM Execution Plan

BIM EXECUTION PLAN VERSION NUMBER: « »
DATE: « »

PROJECT NAME:
(Name and location or address of the Project)

« »
« »

PROJECT OWNER:
(Name and address)

« »
« »

EXHIBIT NAME:
(Identify, by date and full title, the BIM and Digital Data Exhibit for the Project (the "Exhibit"))

« »

INTENDED GOALS FOR MODELS ON THE PROJECT:
(Summarize the intended goals for Model documentation, process, and workflow.)

« »

TABLE OF ARTICLES

1 PROJECT INFORMATION

2 DESIGNATED DELIVERY MILESTONES FOR MODEL VERSIONS

3 SOFTWARE REQUIREMENTS AND FILE EXCHANGE PROTOCOL

4 DATA SECURITY MEASURES

5 MODELING PROTOCOLS

6 MODEL MANAGEMENT PROTOCOLS

7 LEVELS OF DEVELOPMENT

8 RELIANCE AUTHORIZATION PROTOCOLS FOR INTERIM DELIVERABLES

9 IDENTIFICATION OF MODELS

10 OTHER BIM OR MODELING PROVISIONS

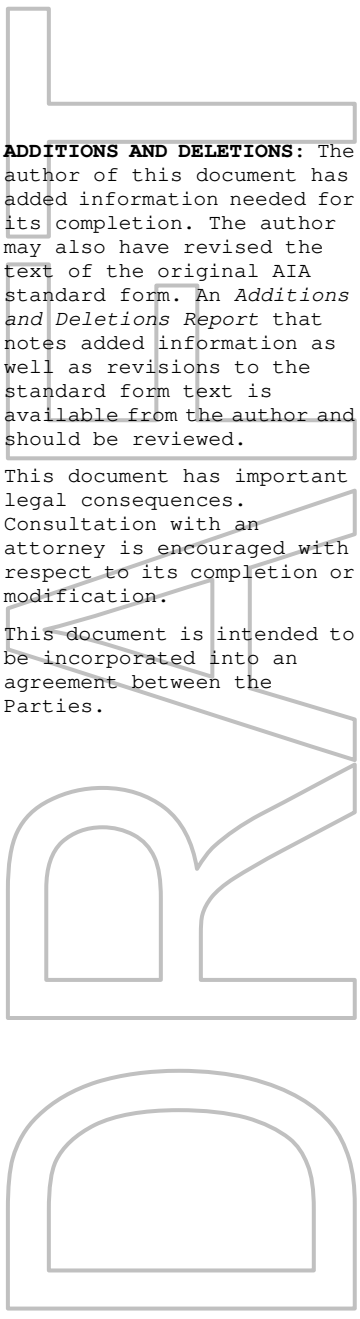
11 EXHIBITS AND ATTACHMENTS

The terms used in this BIM Execution Plan have the same meaning as those in the Exhibit.

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

This document is intended to be incorporated into an agreement between the Parties.



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This BIM Execution Plan may be updated, as appropriate, in accordance with the terms of the Exhibit.

ARTICLE 1 PROJECT INFORMATION

§ 1.1 Project Participants Directory

(Identify all Project Participants developing or using Models, their discipline or trade, and contact information for their key representatives.)

Project Participant *(Firm or company name)*	Discipline or Trade	Contact Name *(Insert individual name and Project role or title)*	Contact Information *(Insert phone number, email address, and other contact information)*
« »			

§ 1.2 Project Schedule

(Insert or attach the Project schedule, including a detailed schedule for Model development. If appropriate, include the schedule's version or date.)

« »

§ 1.3 Existing Data

(Describe any existing survey files, as-built files, documents, or BIM content. Include any license or usage restrictions.)

« »

ARTICLE 2 DESIGNATED DELIVERY MILESTONES FOR MODEL VERSIONS

Designated Delivery Milestones for Model Versions

(Insert or attach the delivery schedule, identifying Designated Delivery Milestones for Model Versions. State whether a Model Element Table will be included for this purpose as set forth in Article 7.)

« »

ARTICLE 3 SOFTWARE REQUIREMENTS AND FILE EXCHANGE PROTOCOL

§ 3.1 Modeling Software

(Indicate software and version(s) to be used for modeling and any other necessary information.)

Software	Version	Other Information

§ 3.1.1 Modeling Software Updates. All Project Participants agree to coordinate software updates prior to making any Model file upgrades.

§ 3.2 Other Software Tools

(Indicate other software tools to be used to interface with Models, such as for analysis, coordination, quality management, etc. Include version and update restrictions, if any.)

« »

§ 3.3 File Exchange Protocols

§ 3.3.1 The Project Participants agree to share their respective Model Portion updates as follows:
(*Check the appropriate box*.)

[« »] **§ 3.3.1.1 Cloud-Based Collaboration.** The Project Participants agree to use a cloud-based Modeling software platform for developing and sharing Models as follows:

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(Indicate software, licensing, and other requirements for hosting the Project. Identify the Project Participant responsible for hosting the Project. Indicate the frequency for Model updates, such as daily, identifying the time of day.)

« »

[« »] **§ 3.3.1.2 Separate Model Collaboration.** The Project Participants agree to use file sharing of separately developed Models, and shall develop and share their Model Portions as follows:
(Indicate the requirements for preparation of the Model Portion before it is transmitted, including how to handle links and exclusions of links, auditing, and compacting. Indicate the means of transmission, if appropriate. Indicate the frequency of file exchange for Model updates, such as at milestones, or weekly, identifying the day of the week.)

« »

[« »] **§ 3.3.1.3 Other:**
(Specify the type of Model collaboration, which may include a hybrid of cloud-based and separate Model development.)

« »

§ 3.4 Collaboration Protocols. The Project Participants' protocols for the collaborative use of Models, if any, including communication protocols, method of decision tracking, and co-location requirements are as follows:

« »

§ 3.4.1 Training and Support Parameters. The parameters for any training or support program(s) that will be implemented with respect to any collaboration protocols or technical requirements are as follows:

« »

§ 3.4.2 Training and Support Costs. The Project Participants are each responsible for their respective software training and support, and associated costs, unless set forth below:
(Identify required software to be used on the Project and for which the Project Participants will be compensated for training and support, and state how the Project Participants will be compensated.)

« »

ARTICLE 4 DATA SECURITY MEASURES

Data Security Measures. In addition to those data security measures identified in the Exhibit, the Project Participants agree to implement the following data security protocols:
(Indicate data security measures, such as data storage, backup, and security measures, to be implemented by all Project Participants.)

« »

ARTICLE 5 MODELING PROTOCOLS

§ 5.1 Project Coordinates. Project coordinates, including Project north, true north angle, and physical horizontal and vertical location in real space, are set forth below. Project coordinates will not be changed without prior agreement from all Project Participants.
(Indicate the Project coordinates, which can be described in writing, represented graphically, or both.)

« »

§ 5.2 Model Data Subdivisions. Model Authors agree to reasonably minimize the subdivision of their Model Portion(s). Any changes to subdivided Model Portions shall be communicated to all Project Participants.

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§ 5.3 Common Data Fields
(Indicate common data fields intended to be shared for sheet indices and Model coordination.)

« »

§ 5.4 Construction Phasing. If the Project will be constructed in separate phases, then indicate the phases below. The Project Participants agree that Model phases will be consistent across all Models. If additional phases, or modifications to phases indicated below, are required, then all Project Participants agree to use any new or modified phases.
(Indicate the phases for the Project, such as when the Project includes existing buildings.)

« »

§ 5.5 Sheets
(Indicate the standard format(s) for 2D output(s), such as sheet sizes for the Project, title block format, and requirements to name, number, and identify deliverables.)

« »

§ 5.6 Design Options
(Indicate any protocols for addressing or exploring design options.)

« »

§ 5.7 File Naming Conventions
(Indicate protocols for naming each type of file.)

« »

§ 5.8 Modeling Standards
(Indicate standards to be used by the Project Participants, or attach and identify a separate document.)

« »

ARTICLE 6 MODEL MANAGEMENT PROTOCOLS
§ 6.1 Responsibility
(Define individual roles and responsibilities for Model management.)

« »

§ 6.2 Meetings
(Indicate meeting types, the stage or phase within which the meeting occurs, and the meeting frequency.)

Meeting Type	Project Stages or Phases	Frequency

§ 6.3 Quality Control and Model Health.
§ 6.3.1 Internal Quality Control. Each Project Participant is responsible for producing quality Model Portions that can be used and opened effectively by all other Project Participants. Project Participants will perform checks on their respective Model Portions pursuant to Section 6.3.1.1.

§ 6.3.1.1 Model Checking. The following checks should be performed by each Model Author to assure Model quality:
(Describe each quality control measure to be implemented throughout the development of Model Portions.)

[« »] **§ 6.3.1.1.1 Visual Check.** Perform a visual check to confirm that there are no unintended Model

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components and confirm design intent has been followed:
(Indicate the frequency with which Visual Checks will be performed and modify the description if required.)

« »

[« »] **§ 6.3.1.1.2 Interference Check.** Detect problems within individual Model Portions and with the interface between Model Portions where two building components clash, including where required clearances clash:
(Indicate the frequency with which Interference Checks will be performed and modify the description if required.)

« »

[« »] **§ 6.3.1.1.3 Modeling Protocols Check.** Confirm that the protocols reflected in Article 5 of this BIM Execution Plan have been followed:
(Indicate the frequency with which Modeling Protocols Checks will be performed and modify the description if required.)

« »

[« »] **§ 6.3.1.1.4 Model Integrity Check.** Check for items that affect the integrity of each Model Portion, such as corrupted Models, duplicated Model Elements, software warnings, Models with overly large file sizes, etc.:
(Indicate the frequency with which Model Integrity Checks will be performed and modify the description if required.)

« »

[« »] **§ 6.3.1.1.5 Other:**

« »

§ 6.3.2 External Quality Control. Upon receipt of another Project Participant's Model Portion, Project Participants shall report to the Model Author any Model quality issues discovered. Model Authors shall promptly resolve reported Model quality issues and issue a new Version of the Model Portion.

ARTICLE 7 LEVELS OF DEVELOPMENT

§ 7.1 Level of Development Descriptions. The Level of Development (LOD) descriptions shall be as set forth in the Exhibit.

§ 7.2 The Project Participants intend to identify the LOD for Model Elements at Designated Delivery Milestones as follows:
(Check the appropriate box.)

[« »] AIA Document G205™–2022, Abbreviated Model Element Table

[« »] AIA Document G204™–2022, Model Element Table

[« »] Describe the LOD to be applied to Model Elements as follows:
(Describe how the LOD will be applied to Model Elements. Itemize by discipline or trade as appropriate. If the Project Participants will use a custom model element table, then identify that model element table.)

« »

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§ 7.3 Level of Accuracy. The level(s) of accuracy used for Model Elements indicated as LOD 500 shall be as follows:
(Describe a single level or multiple levels of accuracy that will be applied to LOD 500 Model Elements.)

« »

ARTICLE 8 RELIANCE AUTHORIZATION PROTOCOLS FOR INTERIM DELIVERABLES

For Interim Deliverables, Model Authors will authorize or limit reliance on Model Versions of their respective Model Portions as follows:
(Define the means of authorization, whether described within the Model Version or in a separate document, or both. If appropriate, attach the authorization text or form as an exhibit.)

« »

ARTICLE 9 IDENTIFICATION OF MODELS

§ 9.1 Identification of Model Versions Enumerated as a Contract Document

(Describe how the Project Participants will identify a Model Version enumerated as a Contract Document, if any, such as by file name, by Model Author, through the use of a Model Element Table, or other method.)

« »

§ 9.2 Identification of Models or Model Portions not Enumerated as a Contract Document

(Describe how the Project Participants will identify a Model or Model Portions that are not enumerated as a Contract Document, such as by file name, by Model Author, through the use of a Model Element Table, or other method.)

« »

ARTICLE 10 OTHER BIM OR MODELING PROVISIONS

Other provisions related to BIM or Modeling are as follows:

« »

ARTICLE 11 EXHIBITS AND ATTACHMENTS

(List here any exhibits and attachments to this BIM Execution Plan.)

« »

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SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Startup construction schedule.
2. Contractor's Construction Schedule.
3. Construction schedule updating reports.
4. Daily construction reports.
5. Material location reports.
6. Site condition reports.
7. Unusual event reports.

B. Related Requirements:

1. Section 011200 MULTIPLE CONTRACT SUMMARY for preparing a combined Contractor's Construction Schedule.
2. Section 014000 QUALITY REQUIREMENTS for schedule of tests and inspections.
3. Section 012900 PAYMENT PROCEDURES for schedule of values and requirements for use of cost-loaded schedule for Applications for Payment.

1.2 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for completing an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine the critical path of Project and when activities can be performed.

D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

E. Event: The starting or ending point of an activity.

F. Float: The measure of leeway in starting and completing an activity.

1. Float time belongs to the Owner.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

G. Resource Loading: The allocation of manpower and equipment necessary for completing an activity as scheduled.

1.3 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. Working electronic copy of schedule file.
2. PDF file.

B. Startup construction schedule.

1. Submittal of cost-loaded startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.

C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

F. Construction Schedule Updating Reports: Submit with Applications for Payment.

G. Daily Construction Reports: Submit at weekly intervals.

H. Material Location Reports: Submit at weekly intervals.

I. Site Condition Reports: Submit at time of discovery of differing conditions.

J. Unusual Event Reports: Submit at time of unusual event.

1.4 COORDINATION

A. Coordinate Contractor's Construction Schedule with the schedule of values, list of Prime Contracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities, and schedule them in proper sequence.

1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

B. Time Frame: Extend schedule from date established for commencement of the Work to date of Final Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Temporary Facilities: Indicate start and completion dates for the following as applicable:

    a. Securing of approvals and permits required for performance of the Work.
    b. Temporary facilities.
    c. Construction of mock-ups, prototypes and samples.
    d. Owner interfaces and furnishing of items.
    e. Interfaces with Separate Contracts.
    f. Regulatory agency approvals.
    g. Punch list.

3. Procurement Activities: Include procurement process activities for the following long lead-time items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

4. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
5. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
6. Commissioning Time: Include no fewer than 15 days for commissioning.
7. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.

8. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and Final Completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase as provided in the Contract Documents.
2. Work under More Than One Contract: Include a separate activity for each contract.
3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
6. Work Restrictions: Show the effect of the following items on the schedule:

    a. Coordination with existing construction.
    b. Limitations of continued occupancies.
    c. Uninterruptible services.
    d. Partial occupancy before Substantial Completion.
    e. Use-of-premises restrictions.
    f. Provisions for future construction.
    g. Seasonal variations.
    h. Environmental control.

7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

    a. Subcontract awards.
    b. Submittals.
    c. Purchases.
    d. Mockups.
    e. Fabrication.
    f. Sample testing.
    g. Deliveries.
    h. Installation.
    i. Tests and inspections.
    j. Adjusting.
    k. Curing.
    l. Startup and placement into final use and operation.
    m. Commissioning.

8. Construction Areas: As applicable, identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

    a. Structural completion.

b. Temporary enclosure and space conditioning.
c. Permanent space enclosure.
d. Completion of mechanical installation.
e. Completion of electrical installation.
f. Substantial Completion.

E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.

F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and the Contract Time.

G. Contractor's Construction Schedule Updating: At bi-weekly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate Final Completion percentage for each activity.

H. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.

I. Distribution: Distribute copies of approved schedule to Architect, Owner, all Prime contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

1.6 GANTT-CHART SCHEDULE REQUIREMENTS

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within [30] <Insert number> days of date established for [commencement of the Work] [the Notice to Proceed] [the Notice of Award].

1. Base schedule on the startup construction schedule and additional information received since the start of Project.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in [10] <Insert number> percent increments within time bar.

1.7 CPM SCHEDULE REQUIREMENTS

A. Prepare network diagrams using AON (activity-on-node) format.

B. CPM Schedule: Prepare Contractor's Construction Schedule using a resource-loaded, time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule, so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.

a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates.

2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule to coordinate with the Contract Time.

C. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

a. Preparation and processing of submittals.
b. Mobilization and demobilization.
c. Purchase of materials.
d. Delivery.
e. Fabrication.

f. Utility interruptions.
g. Installation.
h. Work by Owner that may affect or be affected by Contractor's activities.
i. Testing and inspection.
j. Commissioning.
k. Punch list and Final Completion.
l. Activities occurring following Final Completion.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

    a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

D. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall Project schedule.

E. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the schedule of values).

F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

1.8 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Testing and inspection.
8. Accidents.
9. Meetings and significant decisions.
10. Unusual events.
11. Stoppages, delays, shortages, and losses.
12. Meter readings and similar recordings.
13. Emergency procedures.
14. Orders and requests of authorities having jurisdiction.
15. Change Orders received and implemented.
16. Construction Change Directives received and implemented.
17. Services connected and disconnected.
18. Equipment or system tests and startups.
19. Partial completions and occupancies.
20. Substantial Completions authorized.

B. Material Location Reports: At weekly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.
2. Material stored prior to previous report and since removed from storage and installed.
3. Material stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

D. Unusual Event Reports: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

1. Submit unusual event reports directly to Owner within [one] <Insert number> day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

B. Related Requirements:

1. Section 011200 – SUMMARY OF MULTIPLE CONTRACTS for responsibilities of each Prime Contractor.
2. Section 012900 - PAYMENT PROCEDURES for submitting Applications for Payment and the schedule of values.
3. Section 013100 - PROJECT MANAGEMENT AND COORDINATION for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
4. Section 013200 - CONSTRUCTION PROGRESS DOCUMENTATION for submitting schedules and reports, including Contractor's construction schedule.
5. Section 013233 - PHOTOGRAPHIC DOCUMENTATION for submitting preconstruction photographs, periodic construction photographs, and Final Completion construction photographs.
6. Section 014000 - QUALITY REQUIREMENTS for submitting test and inspection reports, and schedule of tests and inspections.
7. Section 017700 - CLOSEOUT PROCEDURES for submitting closeout submittals and maintenance material submittals.
8. Section 017823 - OPERATION AND MAINTENANCE DATA for submitting operation and maintenance manuals.
9. Section 017839 - PROJECT RECORD DOCUMENTS for submitting record Drawings, record Specifications, and record Product Data.
10. Section 017900 - DEMONSTRATION AND TRAINING for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.3 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.

    a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.

3. Format: Arrange the following information in a tabular format:

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal Category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect's final release or approval.
    g. Scheduled dates for purchasing.
    h. Scheduled date of fabrication.
    i. Scheduled dates for installation.
    j. Activity or event number.

1.4 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Architect.
4. Name of Contractor.
5. Name of firm or entity that prepared submittal.
6. Names of subcontractor, manufacturer, and supplier.
7. Unique submittal number, including revision identifier. Include Specification Section number with sequential numeric identifier and numeric suffix for resubmittals.
8. Category and type of submittal.
9. Submittal purpose and description.
10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
11. Drawing number and detail references, as appropriate.
12. Indication of full or partial submittal.

13. Location(s) where product is to be installed, as appropriate.
14. Other necessary identification.

B. Options: Identify options requiring selection by Architect.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. One PDF file per submittal. Name PDF file as follows:

a. Filename include and match unique submittal number followed by Specification Section Title and type of submittal. Example: 123100-2-1_MANUFACTURED METAL CASEWORK-Shop Drawing

E. Submittals Utilizing Web-Based Project Software: Prepare submittals as PDF files or other format indicated by Project management software.

1.5 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Email: Prepare submittals as PDF package and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.

a. Architect will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.

2. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.

a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.

D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block, and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

1.6 SUBMITTAL REQUIREMENTS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

a. Manufacturer's catalog cuts.
b. Manufacturer's product specifications.
c. Standard color charts.
d. Statement of compliance with specified referenced standards.
e. Testing by recognized testing agency.
f. Application of testing agency labels and seals.
g. Notation of coordination requirements.

h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

   a. Wiring diagrams that show factory-installed wiring.
   b. Printed performance curves.
   c. Operational range diagrams.
   d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data unless submittal based on Architect's digital data drawing files is otherwise permitted.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

   a. Identification of products.
   b. Schedules.
   c. Compliance with specified standards.
   d. Notation of coordination requirements.
   e. Notation of dimensions established by field measurement.
   f. Relationship and attachment to adjoining construction clearly indicated.
   g. Seal and signature of professional engineer if specified.

C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.

1. Transmit Samples that contain multiple, related components, such as accessories together in one submittal package.
2. Identification: Permanently attach label on unexposed side of Samples that includes the following:

   a. Project name and submittal number.
   b. Generic description of Sample.
   c. Product name and name of manufacturer.
   d. Sample source.
   e. Number and title of applicable Specification Section.
   f. Specification paragraph number and generic name of each item.

3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics and identification information for record.
4. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
5. Paper Transmittal: Include paper transmittal, including complete submittal information indicated.

6. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

7. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units, showing the full range of colors, textures, and patterns available.

    a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

8. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

    a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned.

        1) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.

E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

G. Certificates:

1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.

H. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

    a. Name of evaluation organization.
    b. Date of evaluation.
    c. Time period when report is in effect.
    d. Product and manufacturers' names.
    e. Description of product.

f. Test procedures and results.
g. Limitations of use.

1.7 DELEGATED DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.8 CONTRACTOR'S REVIEW

A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp and indication in web-based Project management software. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval. They will be returned without action.

1.9 ARCHITECT'S ACTION

A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return.

1. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:

a. Reviewed: Further submission not required. Fabrication may be undertaken, but does not authorize changes to contract Sum or Time.

b. Reviewed as Noted: Drawings may be used to start work, but shall be immediately corrected and resubmitted for final review, if requested. "Reviewed as Noted" does not authorize changes to contract Sum or Time.
c. Return for Corrections: Insufficient information and lack of detail. Fabrication may not be undertaken. Correct and resubmit.
d. Not Reviewed: Drawings returned without checking, not in accordance with the Contract Documents.

B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

C. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

D. Architect will discard submittals received from sources other than Contractor.

E. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, Commissioning Authority, or authorities having jurisdiction are not limited by provisions of this Section.

1.2 DEFINITIONS

A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.

1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).

D. Mockups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.

1. Mockups are used for one or more of the following:

a. Verify selections made under Sample submittals.
b. Demonstrate aesthetic effects.

c. Demonstrate the qualities of products and workmanship.
d. Demonstrate successful installation of interfaces between components and systems.
e. Perform preconstruction testing to determine system performance.

2. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
3. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.

E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.

F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

G. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."

I. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work, to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

J. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect.

1.3 DELEGATED DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.4 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified is the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 ACTION SUBMITTALS

A. Mockup Shop Drawings:

1. Include plans, sections, elevations, and details, indicating materials and size of mockup construction.
2. Indicate manufacturer and model number of individual components.
3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.6 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data: For Contractor's quality-control personnel.

C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:

1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
2. Primary wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.

D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.

4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

F. Reports: Prepare and submit certified written reports and documents as specified.

G. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.7 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, telephone number, and email address of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample-taking and testing and inspection.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement of whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement of whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

1.8 QUALITY ASSURANCE

A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities be performed by entities who are recognized experts in those operations. Specialists will satisfy qualification requirements indicated and engage in the activities indicated.

1. Requirements of authorities having jurisdiction supersede requirements for specialists.

G. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups of size indicated.
2. Build mockups in location indicated or, if not indicated, as directed by Architect.
3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Architect's approval of mockups before starting corresponding Work, fabrication, or construction.
6. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
7. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
8. Demolish and remove mockups when directed unless otherwise indicated.

1.9 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Engage a qualified testing agency to perform quality-control services.

a. Contractor will not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

D. Testing Agency Responsibilities: Cooperate with Architect, Commissioning Authority and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect, Commissioning Authority and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform duties of Contractor.

E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."

F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.

6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspection equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.10 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, as indicated in the Statement of Special Inspections attached to this Section, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures, and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect, Commissioning Authority and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect and Commissioning Authority with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections, and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's, Commissioning Authority's, and authorities' having jurisdiction reference during normal working hours.

1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspection, sample-taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Reviewed": When used to convey Architect's action on Contractor's submittals, applications, and requests, "reviewed" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

J. “Building Code”: The term “building code” and the term “code” refer to regulations of governmental agencies having jurisdiction over the Project.

K. “Similar”: The term “similar” means in its general sense and not necessarily identical.

1.2 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.

C. Conflicting Requirements: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

D. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities.

B. Temporary utilities include, but are not limited to, the following:

1. Sewers and drainage.
2. Water service and distribution.
3. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
4. Heating, ventilation and cooling facilities.
5. Electric power service.
6. Lighting.
7. Telephone service.

C. Support facilities include, but are not limited to, the following:

1. Project identification and temporary signs.
2. Waste disposal facilities.
3. Field offices.
4. Storage and fabrication sheds.
5. Lifts and hoists.
6. Construction aids and miscellaneous services and facilities.
7. Dewatering facilities and drains.
8. Snow removal of construction site.
9. Weed trimming and grass cutting of construction site.

D. Security and protection facilities include, but are not limited to, the following:

1. Environmental protection.
2. Stormwater control.
3. Tree and plant protection.
4. Pest control.
5. Site enclosure fence.
6. Security enclosure and lockup.
7. Barricades, warning signs, and lights.
8. Temporary enclosures.
9. Temporary partitions.
10. Fire protection.

11. Site security lighting.

E. Related Sections include the following:

1. Section 011200 “Multiple Contract Summary”.
2. Section 011400 “Work Restrictions” for use of Project premises, limits of use, and limitations on utility interruptions.
3. Section 008200, “Safety and Health Management Plan Project Requirements.”
4. Section 013300 “Submittal Procedures” for procedures for submitting copies of implementation and termination schedule and utility reports.
5. Section 017300 “Execution” for progress cleaning requirements.
6. Section 017419 “Construction Waste Management” for additional information and procedures.
7. Section 019113 “General Commissioning Requirements” for additional information and procedures.
8. Divisions 23 through 28 for temporary heat, ventilation, and humidity requirements for products in those Sections.
9. Division 32 Sections for construction and maintenance of asphalt paving and cement concrete pavement for temporary roads and paved areas.

1.3 DEFINITIONS

A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

1.4 DIVISION OF RESPONSIBILITIES

A. General: Each prime Contractor is assigned specific responsibilities for certain temporary services and facilities used by other prime Contractors, and other entities at the site. The Contractor for General Construction is responsible for providing temporary services and facilities that are not normal construction activities of other prime Contractors and are not specifically assigned otherwise. All contractors must review this entire Specification for temporary requirements in each Contract.

B. Each prime Contractor is responsible for:

1. Installation, operation, maintenance and removal of each temporary service or facility usually considered at its own normal construction activity, as well as the costs and use charges associated with each such service or facility.
2. Plug-in electric power cords and extension cords, and supplementary plug-in task lighting and special lighting necessary exclusively for its own activities.
3. Its own field office, complete with necessary furniture, utilities and telephone service.
4. Its own storage and fabrication sheds.
5. Heat, ventilation, humidity control and enclosure of the building where these utilities are necessary exclusively for its own activities.
6. Temporary heat as required over the supplied 60 degree F.
7. All hoisting requirements, including hoisting loads in excess of 2-ton, hoisting material or equipment into spaces below grade, and hoisting requirements outside the building enclosure.
8. Collection and disposal of its own hazardous, dangerous, unsanitary or other harmful waste material.
9. Secure lockup of its own tools, materials and equipment.
10. Construction aids and miscellaneous services and facilities necessary exclusively for its own construction activities.

11. General hoisting facilities.
12. Collection and disposal of fluid wastes, including any water containing effluents with or without solids until permanent sewer systems are functional and if permanent systems are equipped and/or permitted to accept such effluents.
13. Separation and disposal of solids prior to release into permanent sewer system.
14. Contractor's responsibility is to perform regular clean up and place construction debris in designated container. Refer to Waste Disposal and Clean Up, Article 3.3.D.
15. Contractor is responsible for management and disposal of all waste generated from all construction activities in accordance with the Construction Waste Management Plan (CWMP).
16. Each Prime Contractor is responsible for removal of their respective waste from new building construction, and all site work related activities and shall follow procedures to direct as much waste as possible from the landfill.
17. Each Prime Contractor shall coordinate its Construction Waste Management Plan (CWMP) and disposal requirements with the other contractors.
18. Each Prime Contractor shall coordinate its CWMP and implementation to improve the efficient use of the construction staging areas.
19. Each Prime Contractor shall perform regular cleanup of construction waste to keep a clean and safe construction site. Owner will re-assign clean up to other contractors and charge the contractor who is not performing the regular cleanup.
20. Waste disposal support as per Article 3.3D.

C. The Contractor for General Construction is responsible for:

1. Temporary facilities and controls that are not otherwise specifically assigned to the Plumbing Contract, Mechanical Contract and Electrical Contract.
2. Unpiped sewers and drainage, including drainage ditches, dry wells, stabilization ponds, and containers.
3. Stormwater control.
4. Unpiped temporary toilet fixtures, wash facilities, and drinking water facilities, including disposable supplies.
5. Temporary project meeting field office.
6. Temporary offices for Owner's testing agents.
7. Temporary roads and paving.
8. Temporary toilets, including disposable supplies.
9. Temporary wash facilities, including disposable supplies.
10. Containerized bottled-water type drinking water units for the project meeting field office.
11. Temporary enclosure of the building.
12. Temporary partitions.
13. Temporary fire protection and temporary fire extinguishers.
14. Temporary heating, ventilation and air conditioning (HVAC), from the Notice to Proceed date to NINETY (90) days prior to scheduled Substantial Completion for all phases of the Project.
15. Rodent and pest control.
16. Barricades, warning signs and lights.
17. Site enclosure fences (chain link fence).
18. Site security.

19. Temporary sidewalks and fencing.
20. Security enclosure and lockup.
21. Environmental protection.
22. Site temporary water service, water trucks, and site water systems until new water service is installed.
23. Dewatering facilities and drains for all site and building areas until permanent systems are installed.
24. Temporary stairs for construction worker access.
25. Traffic controls.
26. Weekly and as-needed street sweeping as directed by Owner due to the accumulation of dirt and debris.
27. Construction Waste Disposal for the Project for all contractors and facilities required to implement a Construction Waste Management Plan for the project in accordance with Section 017419 for all contractors.
28. Maintenance of all erosion and sediment controls per the erosion and sediment drawings. The County Conservation District has final decision in all related E&S requirements and maintenance needs.
29. Project identification, temporary signs and traffic controls.
30. Control and coordination of fire watch activities.
31. Protection of existing finishes to remain.
32. Snow removal and clearing of the site to provide access to all construction work areas, construction parking, and staging areas at all times.
33. Trimming and clearing of all weeds and grass cutting in the construction site to maintain a clean, organized site at all times.
34. Provide Class B First Aid Kit to be kept in the project meeting field office at all times.

D. The Plumbing Contractor is responsible for:

1. Piped temporary water service distribution from the new water service when it is within 5 feet of building.
2. Temporary sewers and drainage.
3. Dewatering facilities and drains for all work that is Plumbing Contractors responsibilities and once permanent construction is installed (e.g. once permanent deck or waterproof decking is installed).
4. Temporary fire hoses and signs.
5. Security enclosure and lockup in coordination with the General Construction Prime Contractor.
6. Piped storm water from roof sections as schedule dictates.
7. Piped temporary toilet fixtures, wash facilities, and drinking water facilities.
8. Plumbing connections to existing systems and temporary facilities and controls furnished by the General Construction Contract, Plumbing Contract, Mechanical Contract, and Electrical Contract.

E. The Heating, Ventilating and Air-Conditioning (HVAC) Contractor is responsible for:

1. Temporary gas service for heating requirements of HVAC Contractor only.
2. Permanent and/or temporary heating, ventilation and air conditioning (HVAC) from NINETY (90) days prior to Substantial Completion for each area until after Owner occupancy.
3. Security enclosure and lockup in coordination with General Prime Contractor.
4. Dewatering and drainage for Work under scope.

F. The Electrical Contractor is responsible for:

1. Temporary electric power service and distribution. This includes office trailer services and distribution for each of the Prime Contractors and the project meeting field office. Coordinate temporary service requirements with the Energy Company.
2. Temporary lighting for building and site.
3. Power lines and outlets for temporary electric water coolers.
4. Connections for illuminated signs.
5. Temporary telephone lines and service to project meeting field office.
6. Data and telecommunications conduit and wiring and service to project meeting field office.
7. Security enclosure and lockup in coordination with the General Prime Contractor.
8. Dewatering and drainage for work under scope.
9. Electrical connections to existing systems and temporary facilities and controls furnished by the General Construction Contract, Plumbing Contract, Mechanical Contract and Electrical Contract.

1.5 USE CHARGES AND OUTLINE REQUIREMENTS

A. General: Cost or use charges for temporary facilities are not chargeable to Owner or Architect and shall be included in the total Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:

1. Owner's construction forces.
2. Occupants of Project.
3. Architect.
4. Testing agencies.
5. Personnel of authorities having jurisdiction.

B. Water Service: General Contractor shall be responsible for all water needs on project, from a water truck, temporary service as shown on the Phasing Drawings, or from new water service, from Notice to Proceed and until new permanent water service is installed and metered to new building. Owner will pay for metered use charges for the Project once the permanent system is installed, tested and accepted by Water Authority.

C. Sewer Service: Each individual Contractor shall be responsible for collecting and disposing of any water containing solids or other effluents with or without solids that are to be disposed of as a function of their work until the permanent septic or sewer system is fully functional and operational. Any effluents not permitted to be discharged into sewer or septic system shall be collected and disposed of by each Contractor responsible for generating the discharge.

D. Electric Service: Electrical Contractor shall furnish and install temporary power service for construction activities. Owner shall pay for all metered use charges from temporary service. Once permanent service is active, Owner will pay for use charges for permanent service.

E. Data and Internet Service: Electrical Contractor shall furnish and install two high speed internet data lines to project meeting field office and internet service/power to site monitoring camera and video storage system as specified.

F. HVAC System:

1. General Contractor shall provide temporary HVAC systems and pay for all HVAC costs for all building areas from Notice to Proceed until NINETY (90) days prior to Substantial Completion.
2. HVAC Contractor is responsible for providing and operating the permanent HVAC system or any temporary HVAC system required for all building areas at all times from NINETY (90) days prior to Substantial Completion until after Owner occupancy. Utility costs for permanent HVAC system use will be paid by Owner. Utility costs for any approved temporary HVAC system provided by HVAC contractor in the

ninety (90) day prior to Substantial Completion period shall be paid by the Owner provided that the temporary HVAC equipment is connected to the permanent HVAC system.

3. General Contractor is responsible to provide any supplemental HVAC equipment, including humidification and/or dehumidification equipment, that is necessary for the installation of new construction and finishes and maintaining equipment in place until Substantial Completion.
4. Owner will not be responsible for any costs for servicing, maintaining or operating temporary or permanent systems until after Substantial Completion of each phase.
5. HVAC Contractor must maintain, operate and extend equipment warranties as required to provide the Owner with a new, clean system with all warranty periods in effect as required by the Contract Documents.
6. HVAC Contractor shall provide a filter change after the date of Substantial Completion.
7. HVAC Contractor shall comply with all the requirements of Article 3.2.G.
8. HVAC Contractor shall provide all necessary controls for safety requirements including smoke or fire monitoring, and with all necessary shutdown features to run and operate temporary or permanent HVAC systems.

G. Clarification of Utility Use Charges:

1. The Owner will pay for utility company metered electrical usage for construction activities and for one job trailer for each prime contractor.
2. The General Contractor will pay for communication usage of the project meeting field office.
3. Communication hook-up fees for the project meeting field office will be paid for by General Contractor.
4. Each Prime Contractor shall pay for their communication usage.

1.6 SUBMITTALS

A. Implementation and Termination Schedule: Within 15 days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.

B. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

C. Temporary Utility Reports: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.

1.7 QUALITY ASSURANCE

A. Standards: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241.

1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
2. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.8 PROJECT CONDITIONS AND OPERATION

A. Temporary Utilities: At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.

1. Temporary Use of Permanent Facilities: Installer of each permanent system and service shall assume responsibility for operation, maintenance, and protection of each permanent system and service during

its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

B. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:

1. Keep temporary services and facilities clean and neat.
2. Relocate temporary services and facilities as required by progress of the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.

B. Portable Chain-Link Fencing: The General Contractor shall provide temporary, post-driven galvanized steel chain link fence, 6'-0" high, 11-gauge wire in a 2" (50-mm) mesh with top and bottom selvages knuckled with movable supported ballast systems. At select locations, where approved by Owner, provide driven posts.

C. Fencing Windscreen Privacy Screen: Polyester fabric scrim with grommets for attachment to chain-link fence, sized to height of fence, in color selected by Architect from manufacturer's standard colors.

D. Tarpaulins: Fire-resistive labeled with flame-spread rating of 15 or less.

E. Water: Potable.

F. Pavement and Concrete: Comply with requirements of Division 03 and 32 Sections.

G. Lumber and Plywood: Comply with requirements of Division 06 Section "Rough Carpentry".

H. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively.

I. Paint: Comply with requirements in Division 09 Section "Painting".

2.2 TEMPORARY FACILITIES

A. General: Provide equipment suitable for use intended.

B. Field Offices:

1. Mobile units with lockable entrances, operable windows, and serviceable finishes; heated and air-conditioned; on foundations adequate for normal loading.
2. Each Prime Contractor shall provide an insulated, weathertight temporary office of sufficient size to accommodate required office personnel at the Project site. Wood clad exteriors shall not be permitted.
3. Project Meeting Field Office: The Contractor for General Construction shall provide, within one month of Notice to Proceed, a new or like-new insulated, weather-tight, prefabricated or mobile office units or similar job-built construction with lockable entrances, operable windows and serviceable finishes. Provide units with windows and lockable door on foundations adequate for office loading. Space shall include a 12' x 60' trailer with the following:
    a. An integrated washroom.
    b. Heating and cooling equipment appropriately sized for the space.
    c. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.
    d. Two offices furnished with drawing table, work desk with storage drawers and rolling office chair, two (2) four-drawer filing cabinets and drawing rack.
    e. A room not less than 400 sq. ft. for project meetings furnished with a conference table, 15 folding chairs and a tackboard. This room will be dedicated for Project Meetings only.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.

1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

2. Extinguisher shall have a valid inspection tag.

B. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

C. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water drinking-water units with both hot and cold water, including paper cup supply.

D. Temporary HVAC Equipment: Unless Owner authorizes use of permanent heating system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.

2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction and marked for intended location and application.

3. Temporary Dehumidifying Equipment: Provide system engineered by temporary equipment supplier for expected conditions and interior environment requirements specified. Provide self-contained, recirculating refrigeration units with water collection and filtration capabilities

a. Equipment shall be sized with sufficient moisture extraction capabilities to maintain ambient interior air within specified relative humidity range.

b. Provide collection and/or drainage capabilities to prevent condensate from re-evaporating in conditioned space or from spilling on floors.

E. Generators: Provide generators sized to power equipment where temporary electric service is of insufficient capacity.

F. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.

G. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.

H. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials.

3.2 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.3 TEMPORARY UTILITY INSTALLATION AND REQUIREMENTS

A. General: Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.

B. Sewers and Drainage by General Contractor: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.

1. Filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
2. Connect temporary sewers to municipal system as directed by sewer department officials.
3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.
4. Provide temporary filter beds, settlement tanks, separators, and similar devices to purify effluent to levels acceptable to authorities having jurisdiction.

C. Water Service:

1. General: Install water service and distribution piping in sizes and pressures adequate for construction.
2. General Contractor is responsible for all water needs on Project using water trucks until new water service is available at the building.
3. After new water service is available at the building, Plumbing Contractor shall provide the following:
    a. Water Service: Use of Owner's new water service facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to like-new condition.
    b. Provide rubber hoses as necessary to serve Project site.
    c. As soon as water is required at each level, extend service to form a temporary water- and fire-protection standpipe. Provide distribution piping. Space outlets so water can be reached with a 100-foot (30-m) hose. Provide one hose at each outlet.
    d. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.
    e. Provide a minimum of 30-psi (200-kPa) static pressure at highest point.

D. Sanitary Facilities and Drinking Water by General Contractor: Provide temporary toilets, hand/wash facilities, and drinking-water fixtures. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.

1. Drinking Water: Install water service and distribution piping in sizes and pressures adequate for construction until permanent water service is in use. Sterilize temporary water piping before use.
2. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, hand sanitizer, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
3. Toilets: Use of Owner's existing toilet facilities will not be permitted unless Owner provides permission. Install self-contained toilet units. Shield toilets to ensure privacy. Contractor shall comply with the requirements of Section 008200, Safety and Health Plan Project Requirements, Article 13.0, Infectious/Communicable Disease Plan (ICDP), Common Practices, Paragraph C for temporary toilet facility requirements.
4. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel. Dispose of drainage properly. Supply cleaning compounds appropriate for each type of material handled. Contractor shall comply with the requirements of Section 008200, Safety and Health Plan Project Requirements, Article 13.0, Infectious/Communicable Disease Plan (ICDP), Common Practices, Paragraph C for hand wash stations.
5. Provide eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel.

E. Chain Link Fence:

1. The General Contractor shall secure the site and furnish gates as shown on Phasing Plan(s) or as required for project and directed by Owner. The fencing and gates shall be relocated and adjusted during the Project as required, as noted on the Phasing Plans(s) and/or as directed by Owner.
2. Temporary fence is to be installed as indicated on the Phasing Plans(s).

F. Temporary HVAC: The General Contractor shall provide temporary HVAC required by construction activities, for curing or drying of completed installations, or protection of installed construction from adverse effects of low temperatures or high humidity from Notice to Proceed to NINETY (90) days prior to Substantial Completion for each new building area. Temporary HVAC shall also be provided in all new building areas scheduled for work in order to maintain productivity of all trade contractors and personnel. Comply with the following:

1. Select safe equipment that will not have a harmful effect on completed installations or elements being installed.
2. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.
3. Maintain the temporary heat to a minimum of 60 degrees F.
4. The General Contractor shall provide all other Prime Contractors with the Project Schedule and the minimum heating requirements to protect the Work as scheduled. If through no fault of any other Prime Contractor, the General Contractor does not maintain the original approved schedule, the General Contractor shall continue to provide temporary heat to other Prime Contractors when required.
5. The General Contractor shall not be responsible for providing temporary heat in permanently unconditioned areas or in areas not scheduled for work, unless the approved schedule is modified and accepted by the Owner and all Prime Contractors.
6. Prime Contractors are responsible to protect their work in unconditioned or unscheduled work areas at no additional expense to the Owner.
7. Prior to the permanent heating system being operational, and when necessary for the proper prosecution of the work, the General Contractor shall provide, maintain, operate and pay all costs including fuel, for sufficient approved heat.

G. Temporary/Existing/Permanent HVAC: The HVAC contractor shall provide HVAC from NINETY (90) days prior to Substantial Completion of each new building area and at all times for all building areas that are occupied or under construction and shall comply with the following:

1. When noted above, the HVAC contractor shall provide, maintain and operate sufficient temporary heating/cooling. If the new permanent heating or cooling system is used during this period, the HVAC contractor shall professionally clean all HVAC systems.
2. The HVAC Contractor shall properly protect all HVAC equipment / systems from construction air dust and debris beginning from initial installation.
3. Select safe equipment that will not have a harmful effect on completed installations or elements being installed.
4. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.
5. Maintain the temporary heat to a minimum of 60 degrees F for construction areas and at 70 degrees F for all occupied areas.
6. At NINETY (90) days prior to Substantial Completion of new building areas, the Owner shall pay for fuel and electric energy used to operate the approved temporary or permanent heating or cooling and exhaust system provided that due care is exercised to avoid excessive use of fuel.
7. Portable heaters will not be acceptable during final finishing operations.
8. The new permanent heating and exhaust system or any portion thereof may be used by the HVAC Contractor to provide temporary heat and exhaust as required for the proper prosecution of the work as long as all the necessary protection and cleanup required by the Specifications and recommended by the manufacturer are strictly followed, and only when outside air is supplied directly to the burners. The HVAC Contractor shall, when operating the permanent system complete all required servicing and adjusting to maintain the system in proper running order to prevent damage to the building or its equipment during the construction period. Units placed in permanent operation must be fully controlled using the final control system operational sequence.
9. When the HVAC Contractor performs startup and begins using the permanent HVAC systems, the Contractor must provide pre-filters, return air filters, plenum filters and or other modifications to the systems necessary to prevent dirt, dust and other contaminants from entering the system. If measures implemented do not prevent dust from entering the systems, the HVAC Contractor shall perform cleaning of duct, coil and other HVAC components necessary to provide clean HVAC systems at Substantial Completion of the Project.
10. Prior to turning over the new permanent heating and ventilating system to the Owner, the HVAC Contractor shall thoroughly clean the system, provide new filters, make re-adjustments as required and bear all cost to place the system in first-class operating condition.
11. The warranty period of individual pieces of equipment of the permanent system used during the construction period shall be extended during the temporary use period and the starting date used for determination of expiration for such warranties shall begin upon final acceptance of the project by the Owner.
12. Work which is damaged as a result of improper or insufficient climate control shall be removed and replaced.

H. Ventilation and Humidity Control by General Contractor:

1. Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
2. Temporary Humidity Control:
    a. General: Where control of ambient humidity is required for proper performance of the work, or for curing/drying of installed work, or for protection of installed work from deterioration due to variations in ambient conditions and/or adverse effects of high humidity, the General

Contractor shall provide temporary humidification or dehumidification equipment to maintain the required conditions. This equipment may require air conditioning to achieve the desired results and maintain the Project schedule. Determination of the required equipment is the responsibility of the General Contractor. Coordinate the use of the equipment with temporary heating to produce the required conditions with a minimum overall use of energy.

b. Construction Dehumidification (ongoing): The General Contractor shall provide portable dehumidification units for use during construction. Units shall be provided as required to maintain optimal building moisture conditions required for the proper performance of the Work. Moisture levels shall be maintained throughout both occupied and unoccupied areas of the facilities.

c. Units shall be refrigeration-based and shall include standard 115V power cord, humidistat, integral condensate pump, wheels and handle. Units shall be as manufactured by Ebac or approved equal. Dehumidifier capacities and quantities shall be as follows:

i. Quantity 15 - Minimum 25 gallons/day capacity (Ebac BD150CR or equal).

ii. Locations shall be as agreed upon in the field with the Architect and Owner.

d. General Contractor shall furnish and install drainage hoses and connections to discharge condensate to exterior of building at locations acceptable to the Owner and Architect.

e. The Electrical Contractor shall be responsible to distribute power sources throughout each area of the building dedicated for the purpose of power for the humidification and/or dehumidification units. This power shall be in addition to power required by the trades for performance of their Work.

I. Electric Power Service by Electrical Contractor: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnecting means, and automatic ground-fault interrupters.

1. Install power distribution wiring overhead or underground and rise vertically where least exposed to damage.

2. Electric power service including all necessary poles and accessories shall be extended from off-site available sources after coordination with local electric utility company.

3. Provide adequate temporary electric service and for the following temporary field offices for light, power, heating and cooling located on the site:

1 – General Contractor

1 – Project Meeting Field Office (provided by General Contractor)*

1 – HVAC Contractor

1 – Plumbing Contractor

1 – Electrical Contractor

*Field office for Owner's testing agents: Testing personnel will share the project meeting field office provided by General Contractor.

4. Provide or extend the following temporary construction electric services to the various building areas within forty (40) days of Notice to Proceed unless noted otherwise:

a. 120/208-volt, three phase, four-wire wye with a solid neutral service.

b. Transformation and power distribution as shown as required for temporary needs specified unless noted otherwise on Construction Documents.

c. Power receptacles distributed across the building as the Project develops. Minimum requirements for the building are as follows:

- Fifty (50) 120-volt receptacles
- Forty (40) 240-volt receptacles

d. Temporary power for trailers and construction area.

e. Eighteen (18) temporary connections to HVAC temporary heating units when directed by Owner.

f. Five (5) site lights when directed by Owner (see Article L below).

5. All extensions from the temporary power receptacles shall be provided by the parties requiring power.

J. Electric Power Service: Use of Owner's new electric power service will be permitted, as long as equipment is maintained in a condition acceptable to Owner.

K. Electric Distribution by Electrical Contractor: Provide receptacle outlets adequate for connection of power tools and equipment in new and existing building areas.

1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.

2. Provide warning signs at power outlets other than 110 to 120 V.

3. Provide metal conduit, tubing, or metallic cable for wiring exposed to possible damage. Provide rigid steel conduits for wiring exposed on grades, floors, decks, or other traffic areas.

4. Provide metal conduit enclosures or boxes for wiring devices.

5. Provide 4-gang outlets, spaced so 100-foot (30-m) extension cord can reach each area for power hand tools and task lighting. Provide a separate 125-V ac, 20-A circuit for each outlet.

6. At earliest feasible time, but no later than 60 days prior to Substantial Completion of each Phase, provide permanent electric distribution systems.

7. Provide 150A, 208V, 3-phase power distribution for temporary connections of floor grinders during floor installation. Provide power distribution at multiple locations as required to ensure the grinders can cover the entire floor area using a 100' cord. Power distribution may be provided from temporary source or permanent power distribution where available. Remove all temporary power distribution when it is no longer required.

L. Lighting by Electrical Contractor: Provide and maintain temporary lighting with local switching that provides adequate illumination for construction operations and traffic conditions. Wherever overhead floor or roof deck has been installed, the Electrical Contractor shall provide temporary lighting with local switching.

1. For New Construction:

a. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

b. Provide one 100-W incandescent lamp per 500 sq. ft. (45 sq. m), uniformly distributed, for general lighting, or equivalent illumination.

c. Provide one 100-W incandescent lamp every 50 feet (15 m) in traffic areas.

d. Provide one 100-W incandescent lamp per story in stairways and ladder runs, located to illuminate each landing and flight.

e. Install exterior-yard site lighting that will provide adequate illumination for construction operations, security, traffic conditions, and signage visibility when the Work is being performed.

f. Provide five (5) pole mounted (20 ft. high, 200 watt) temporary security lights controlled by a photocell to be installed as directed by Owner.

g. At earliest feasible time, but no later than 60 days prior to Substantial Completion of each Phase, provide permanent lighting systems both inside the building and on the site for use in completing construction and lighting the project site. Contractor must operate, maintain and protect the permanent systems through final completion of the project and provide full project warranty from the contract completion date of the project.

M. Telephone Service by Electrical Contractor: Provide temporary telephone service throughout construction period for common-use facilities used by all personnel engaged in construction activities. Install separate telephone line for each field office, 2 phone lines to General Contractor, 2 lines to project meeting field office.

N. Data and internet wiring by Electrical Contractor: Provide two high speed internet data connections to project meeting field office. Connections shall include face plate and jack(s).

3.4 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.
2. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines in accordance with ASTM E136. Comply with NFPA 241.
3. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will not be permitted to use permanent facilities.

B. Temporary Roads and Paved Areas by General Contractor: Construct and maintain temporary roads and paved areas adequate to support loads and to withstand exposure to traffic during construction period. Locate temporary roads and paved areas in same location as permanent roads and paved areas and in compliance with the Phasing Plan(s). Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Section 312000 “Earth Moving.”
3. Recondition base after temporary use, including removing contaminated material, regrading, proof rolling, compacting, and testing.
4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Division 32 Section “Hot-Mix Asphalt Paving”.
5. Provide dust-control treatment that is non-polluting and non-tracking. Re-apply treatment as required to minimize dust.
6. Cooperate with Work by others on the adjoining property construction.

C. Dewatering Facilities and Drains: Comply with requirements in applicable Division 31 Sections for temporary drainage and dewatering facilities and operations not directly associated with construction activities included in individual Sections. Where feasible, use same facilities. Maintain Project site, excavations, and all construction areas free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining property nor endanger permanent Work or temporary facilities is by General Contractor.
2. Before connection and operation of permanent drainage piping system, provide temporary drainage where roofing or similar waterproof deck construction is completed is by Plumbing Contractor.
3. Prime Contractor installing drains and any pipes for storm or sanitary systems shall verify that all systems are clear of debris prior to Substantial Completion. If necessary, flush all systems.
4. Remove snow and ice as required to minimize accumulations is by General Contractor.
5. Remove water from trenches, excavations or other work of each contract by individual Prime Contractors.

D. Waste Disposal Facilities and Cleanup: Each Prime Contractor will provide waste-collection containers in sizes adequate to handle regular waste generated from construction operations. Each Prime Contractor is responsible for collecting, and disposing of, their respective construction waste generated from new building construction,

existing building demolition and site work operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste and dispose of this waste.

1. Contractors shall develop a Construction Waste Management Plan (CWMP) to consolidate and organize the area designated for each Prime Contractor to locate dumpsters. Contractor shall perform waste collection and disposal on a daily basis for all site and building areas in full compliance with the CWMP.
2. Contractor shall clean up all work areas on a daily basis including all site and building areas in full compliance with the CWMP. Contractor shall also segregate materials and place them in designated containers.
3. General Contractor shall be responsible for daily cleanup of all areas of the building unless noted otherwise below. HVAC contractor shall be responsible for daily cleanup of all mechanical and electrical rooms. All contractors shall be responsible for daily cleanup of the areas in which they are working.
4. Owner shall deduct $200.00 per day from each contractor that is not performing the required daily cleanup. The total amount will be deducted from the contractor's total contract sum. Owner will re-assign cleanup or hire independent contractor to perform cleanup. Owner may also withhold processing of payment request until cleanup duties are resumed to Owner's satisfaction.
5. Each Contractor is responsible for removal of their respective waste from Work associated with its Contract and shall follow procedures to direct as much waste as possible from the landfill.
6. CWM shall coordinate the locations of the waste containers with Prime Contractors and as noted on Phasing Plan(s). All locations to be confirmed with Owner prior to placement.
7. General Contractor shall provide equipment and labor required for positioning and relocating waste containers on site as well as compacting or consolidating materials in the containers.
8. GC's waste hauler will remove all waste containers from the Project site.
9. Each Contractor shall comply with Construction Waste Management Plan requirements.

E. Janitorial Services by General Contractor: Provide janitorial services on a weekly basis for the project meeting field office, first-aid stations and toilets.

F. Field Offices:

1. Locate facility where it will serve the project adequately and result in minimum interference with the performance of the work. Relocate and modify facilities as required. Furnish facility prior to start of work and remove facility at final completion of project. Provide all utilities to service facility, including electric service, lighting, and facilities for telephone service.

G. Temporary Stairs by General Contractor: Until permanent stairs are available, provide temporary stairs where ladders are not adequate. Cover finished, permanent stairs with protective covering of plywood or similar material so finishes will be undamaged at time of acceptance. At Substantial Completion, restore stairs to condition existing before initial use.

1. Provide protective coverings, barriers, devices, signs or other procedures to protect stairs and to maintain means of egress. If, despite such protection, stairs become damaged, restore damaged areas so no evidence remains of correction work.

H. Traffic Controls by General Contractor: Provide temporary traffic controls at junction of temporary roads with public roads. Include warning signs for public traffic and "STOP" signs for entrance onto public roads. Provide construction site signage on adjacent roads and site to direct public and construction traffic (both vehicular and pedestrian), comply with Owner's request for all site and road signage. Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain, including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

I. Project Identification and Temporary Signs by General Contractor:

1. Prepare and install one 4' x 8' Project identification sign as indicated on the drawings or directed by Architect. Do not permit installation of unauthorized signs.
2. Prepare and install up to 6 signs 4' x 3' with information to direct and control traffic on site and in building. Apply graphics and text as directed by Owner. Install where directed.
3. Engage an experienced sign painter to apply graphics for Project identification signs. Comply with details provided by the Architect.
4. Construct signs of exterior-type Grade B-B high-density concrete form overlay plywood in sizes and thicknesses indicated. Support on posts or framing of preservative-treated wood or steel.
5. Paint sign panel and applied graphics with exterior-grade alkyd gloss enamel over exterior primer. Architect will provide digital file for graphic. Adhere custom vinyl graphic after paint has cured. Edge seal vinyl graphic using a fine-tip brush, painting the edges of the film with a commercial grade edge sealer.
6. Comply with disease-related signage requirements of Section 008200, Safety and Health Management Plan Requirements, Article 13.0, Infectious Communicable Disease Plan, Common Practices, Paragraph B.2.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION - BY GENERAL CONTRACTOR

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.

C. Stormwater Control: Provide silt barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of stormwater from heavy rains.

D. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from construction damage. Protect tree root systems from damage, flooding, and erosion.

E. Site Enclosure Fence: Before construction operations begin, install chain-link enclosure fence with lockable entrance gates. Locate where indicated or enclose entire Project site or portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering site except by entrance gates.

1. Set fence posts below grade a minimum of 3 feet.
2. Provide gate in sizes and at locations necessary to accommodate delivery vehicles and other construction operations.
3. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Provide Owner with one set of keys and/or access code(s).
4. Provide plywood on fencing adjacent to existing windows and doors.

F. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft and similar violations of security. Lock entrances at end of each workday.

G. Site Security: Ensure all windows, doors and gates are closed and secured at the conclusion of each day in scheduled work areas.

H. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.

1. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8-inch thick exterior plywood.
2. Where indicated on phasing plan provide concrete 'Jersey' barriers.

I. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
2. Vertical Openings: Close openings of 25 sq. ft. or less with plywood or similar materials.
3. Horizontal Openings: Close openings in floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
4. Install tarpaulins securely using fire-retardant-treated wood framing and other materials.
5. Where temporary wood or plywood enclosure exceeds 100 sq. ft. in area, use fire-retardant-treated material for framing and main sheathing.
6. Provide temporary enclosures as required to meet criteria for permanent enclosure no later than the beginning of any of the following Work:
    a. Spray fireproofing.
    b. Interior finishes, including gypsum wallboard finishing, painting and wall coverings.
    c. Architectural woodwork.
    d. Institutional casework.
    e. Install temporary enclosures before time frames stated above when necessary to maintain interior relative humidity levels and temperatures as required to promote drying of concrete and concrete masonry substrates so that they achieve low enough moisture content and vapor emission levels to permit timely installation of finishes.

J. Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

1. Construction dustproof partitions of not less than nominal 4-inch studs, 5/8-inch gypsum wallboard with joints taped on occupied side, and 1/2-inch fire retardant plywood on construction side.
2. Construct dustproof, floor-to-ceiling partitions of not less than nominal 4-inch studs, 2 layers of 3-mil polyethylene sheets, inside and outside temporary enclosure. Cover floor with 2 layers of 3-mil polyethylene sheets, extending sheets 18 inches up the side walls. Overlap and tape full length of joints. Cover floor with 3/4-inch fire-retardant plywood.
3. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
4. Protect air-handling equipment.
5. Weatherstrip openings.

K. Exterior Surface Protection:

1. Where sequence of operations exposes exterior finished materials including, but not limited to factory finished metal, anodized metal, glass and the like, to mortars, grouts, alkalis, acids, strong detergents or other materials that may cause damage to adjacent finishes, provide surface protection materials completely over surface to be protected.
2. Comply with surface protection material manufacturer's recommendations. Do not leave materials in place beyond maximum time limit.
3. Remove protection materials completely when at-risk work is complete.

L. Traffic Surface Protection:

1. New Finished Traffic Surfaces: From the time of installation to just before inspection for Substantial Completion, overlay traffic surfaces with traffic protection products as recommended by manufacturer for substrates to be protected. Replace traffic protection products when damaged. Where specified products do not meet construction traffic demands or when required by Architect or Owner, provide more substantial protection as specified below for existing traffic surfaces to remain.

2. Existing Finished Traffic Surfaces to Remain: From the time of one week before the commencement of any work of a phase of any prime contractor in area or areas immediately adjacent to floors to be protected, overlay traffic surfaces with one layer of craft paper and follow with one layer of plywood. Secure plywood with heavy adhesive tape. Maintain protection for duration of work in area and remove just before inspection for Substantial Completion.

M. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

1. Provide fire extinguishers, installed on walls on mounting brackets, visible and accessible from space being served, with sign mounted above.

2. Develop and supervise an overall fire-prevention and first-aid fire-protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3. Provide temporary standpipes and hoses for fire protection of sufficient length to reach construction areas. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

4. Prohibit smoking and vaping in construction areas.

5. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.

6. Coordinate activities with Fire Watch. Notify Fire Watch of hours of operation and planned fire-risk activities such as welding within construction areas.

N. Fire Watch: Provide adequate number of and properly trained personnel to provide fire watch in accordance with NFPA 51B “Standard for Fire Protection During Welding, Cutting and Other Hot Work 1999 Edition, NFPA 101 “Life Safety Code”, Articles 9.6.1.8 and 9.7.6.1 (including appendix) and as follows:

1. Fire Watch personnel shall be trained and provide services in compliance with NFPA 601 “Standard for Security Services in Fire Loss Prevention” and shall be acceptable to the Authorities Having Jurisdiction.

2. The responsible party for Fire Watch Services as defined in Division 01 Section “Multiple Contracts Summary” shall be considered “Management” for the purposes of complying with the referenced standards.

3. Fire Watch personnel shall be provided with portable communications to permit immediate communication with school authorities, contractors and public emergency services.

4. Conduct a coordination meeting in advance of the earliest requirement for Fire Watch with the Owner, respective Project Coordinators, Authorities Having Jurisdiction and Architect.

   a. Develop an emergency response plan for risks associated with construction. Coordinate with Owner’s existing security and emergency response plan.

   b. Establish the lines of and order of communications based on each anticipated risk type.

   c. Project Coordinators shall record and transmit minutes of the meeting to attendees and to Fire Watch personnel.

5. Fire Watch shall be provided at the Work by respective responsible entity as defined in Division 01 Section “Multiple Contract Summary.”

a. When hot work is being conducted.

b. When fire alarm is not in operation in occupied areas for time greater than 4 hours.

c. When fire suppression system is not in operation in occupied areas for time greater than 4 hours.

O. Fire Extinguishers: Class A stored-pressure water-type extinguishers. Other Locations: Class ABC dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for exposures.

1. Locate fire extinguishers where convenient and effective for their intended purpose; provide not less than one extinguisher on each floor at or near each usable stairwell.

2. Store combustible materials in containers in fire-safe locations.

3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting. Prohibit smoking/vaping on the Project site and within all building areas.

4. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition.

P. Permanent Fire Protection: At earliest feasible date in each area of Project, complete installation of permanent fire-protection in facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

2. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

D. Temporary Facility Changeover for Security and Protection: Except for using permanent fire protection as soon as available, do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

E. Termination, Removal and Temporary Facility Changeover: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are the property of Contractor. Owner reserves right to take possession of Project identification signs.

2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns and dispose of in a legal manner. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.

3. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Section 017700 “Closeout Procedures.”
4. Replace significantly worn parts and parts that have been subject to unusual operating conditions.
5. Replace lamps that are burned out or noticeably dimmed by substantial hours of use.

3.7 NO SMOKING

A. Smoking or vaping will not be permitted on the entire Project site.

3.8 IDENTIFICATION OR SIGNS

A. Only one project sign will be permitted for the site, provided by the General Contractor and listing all contractors. Individual contractor signs will not be permitted.

3.9 COMPLIANCE WITH TEMPORARY FACILITIES AND CONTROLS

A. If contractor does not comply with any of the requirements of this Section, Architect reserves the right to recommend to Owner to withhold adequate funds from payment applications to pay for completing the Work as required.

END OF SECTION

SECTION 01.5526 - TRAFFIC REGULATION

PART 1 - GENERAL

1.01 SECTION DESCRIPTION

A. This Section involves the Contractor's obligations relative to maintaining the safe and efficient movement of traffic in the vicinity of construction.

B. Contractor will be required to furnish, erect, and maintain traffic cones, drums, barricades, flashing danger signal lights, directional signs and provide trained and equipped flagmen as required to restrict the movement of traffic within the construction areas and to clearly indicate the restrictions well in advance to vehicular traffic.

1.02 SECTION INCLUDES

A. Traffic Control Plan
B. Notification
C. Construction parking controls.
D. Flag persons.
E. Flares and lights.
F. Haul routes.
G. Traffic signs and signals.
H. Other Requirements pouches protein
I. Removal.

PART 2 - PRODUCTS

2.01 SIGNS, SIGNALS, AND DEVICES

A. Post Mounted and Wall Mounted Traffic Control and Informational Signs: As approved by the authority having jurisdiction.

B. Traffic Control Signals: As approved by the authority having jurisdiction.

C. Traffic Cones and Drums, Flares and Lights: As approved by the authority having jurisdiction.

D. Flagperson Equipment: As required by the authority having jurisdiction.

PART 3 - EXECUTION

3.01 TRAFFIC CONTROL PLAN

A. Contractor shall implement any Traffic Control Plan requirements imposed by the Road Opening Permit issued by the Borough and Highway Occupancy Permit issued by PennDOT.

3.02 NOTIFICATIONS

A. Contractor shall provide advance notification to any parties so noted in the local municipal Road Opening Permit and PennDOT issued Highway Occupancy Permit in accordance with the required time schedule.

B. **The Contractor shall notify the following parties at least twenty four (24) hours in advance of any work within the roadway:**

1. Borough of Conshohocken
2. Local Municipal Police
3. Local Fire Company
4. Local School District
5. Local Ambulance Service
6. All affected residents

C. Contractor shall obtain advance approval from the Borough should it be necessary to restrict traffic in or along any roads, including temporary closure of a road.

D. At least one lane must be open for traffic during non-working periods and Contractor must be prepared to allow passage of emergency vehicles at any time.

3.03 CONSTRUCTION PARKING CONTROLS

A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and Owner's operations.

B. Monitor parking of construction personnel's vehicles. Maintain vehicular access to and through parking areas.

C. Prevent parking on or adjacent to access roads or in non- designated areas.

3.04 FLAG PERSONS

A. Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.

3.05 HAUL ROUTES

A. Consult with the Owner for routes to be used for haul routes and site access.

B. Confine construction traffic to designated routes.

3.06 TRAFFIC SIGNS AND SIGNALS

A. Install and operate traffic controls to direct and maintain orderly flow of traffic in areas under Contractor’s control, and areas affected by Contractor’s operations.

B. Relocate as Work progresses, to maintain effective traffic control.

3.07 OTHER REQUIREMENTS

A. Maintain access at all times during non-working periods and to the maximum extent feasible during working periods to and within the site, all driveways, and entrances of the site and adjacent properties. In this regard, use and maintenance of steel plates or other decking across the trench may be necessary to reduce to a minimum interference with access to the adjacent properties.

B. Provide safe decking over open trenches in or along highways or roads during non-work periods by the use and maintenance of steel plates or other decking, which shall have sufficient strength to safely support all traffic including truck loads.

3.08 REMOVAL

A. Remove equipment and devices when all work, including repaving, has been completed.

B. Repair damage caused by installation.

C. Remove post settings to a depth of 2 feet.

END OF SECTION

SECTION 01.5713 - SOIL EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.01 SECTION DESCRIPTION

A. The Work of This Section Includes:

1. Contractor shall implement and maintain the E&S and Soil Management Plans prepared for the Work as shown on the Drawings and described in this Section.

2. Contractor shall carry out the construction operations in such a manner that soil erosion and resulting turbid stormwater runoff and sedimentation are minimized.

1.02 QUALITY ASSURANCE

A. Reference Standards:

1. Pennsylvania Department of Environmental Protection Erosion and Sediment Pollution Control Program Manual

2. Pennsylvania Department of Transportation Publication 408 Specifications and Publication 72 Standards for Roadway Construction

1.03 JOB CONDITIONS

A. The associated work activities include but are not limited to the following items:

1. Temporary and permanent measures which will have to be undertaken before, during and after construction to control sediment from being carried onto adjoining properties and roadways and/or into storm sewers, swales, or watercourses as a result of stormwater runoff.

2. Temporary control devices as shown on the Drawings and as described in these Specifications for providing the trapping of sediment resulting from construction activities and to reduce stormwater velocity to minimize erosion.

3. Inspection of the erosion and sediment control measures on a weekly basis and after every storm event and maintenance throughout the life of the Work, including measures as shown on the Drawings and other measures required for the construction of the Work.

4. Removal of the temporary control devices and stabilization of disturbed areas upon completion of the Work.

5. Soil erosion and sediment control practices consistent with the latest editions of the Reference Standards.

PART 2 - PRODUCTS

2.01 MATERIALS

A. The Materials associated with the Work include but are not limited to the following items:

1. Compost Filter Sock
2. Rock Construction Entrance
3. Erosion Control Matting
4. Temporary and Final Seeding
5. Orange Construction Fence
6. Tree Protection Fence
7. Inlet Protection
8. Sediment Filter Bag

PART 3 - EXECUTION

3.01 TEMPORARY CONTROL MEASURES

1. Install erosion and sediment control measures in accordance with the Drawings, including the Sequence of Construction, and Reference Standards.
2. Limit the removal of natural ground cover to the minimum area required for construction within non-paved areas.
3. Perform temporary seeding and mulching immediately upon completion of earthmoving, within seasonal constraints, of disturbed areas which are not actively being regraded until final grading and stabilization can be accomplished. Temporary seeding is covered in Section 32 92 00.
4. Dewatering or pumping out of excavated areas directly into existing storm ditches or natural channels is prohibited. Contractor must make use of sediment filters or other methods acceptable to the Resident Project Representative and in accordance with current Pennsylvania Department of Environmental Protection guidance and procedures.

3.02 PERMANENT CONTROL MEASURES

A. Perform permanent seeding and mulching of any disturbed areas immediately following final grading of any non-paved areas within seasonal constraints. Seeding is covered in Section 32 92 00.

3.03 FIELD MODIFICATIONS

A. Owner reserves the right to require modifications to any or all sediment control measures provided in order to establish proper soil erosion and sedimentation control. In addition, any measures recommended or required by the Montgomery County Conservation District and/or Pennsylvania Department of Environmental Protection shall be promptly implemented.

END OF SECTION

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:

1. Section 011000 "Summary" for Contractor requirements related to Owner-furnished products.
2. Section 012100 "Allowances" for products selected under an allowance.
3. Section 012300 "Alternates" for products selected under an alternate.
4. Section 012500 "Substitution Procedures" for requests for substitutions.
5. Section 014200 "References" for applicable industry standards for products specified.
6. Section 01770 "Closeout Procedures" for submitting warranties.

1.2 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.

1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension,

durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:

1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.

E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 013300 "Submittal Procedures."

F. Substitution: Refer to Section 012500 "Substitution Procedures" for definition and limitations on substitutions.

1.3 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1. Resolution of Compatibility Disputes between Multiple Contractors:

a. Contractors are responsible for providing products and construction methods compatible with products and construction methods of other contractors.
b. If a dispute arises between the multiple contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:

a. Name of product and manufacturer.
b. Model and serial number.
c. Capacity.
d. Speed.
e. Ratings.

3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

1.4 COORDINATION

A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and that products are undamaged and properly protected.

C. Storage:

1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
2. Store products to allow for inspection and measurement of quantity or counting of units.
3. Store materials in a manner that will not endanger Project structure.
4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.
5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

a. Submit additional documentation required by Architect in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by the Architect, whose determination is final.

B. Product Selection Procedures:

1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

   a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."

3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.

   a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
   b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.

5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

   a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."

6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.

   a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
   b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.

7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or

a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

a. For approval of products by unnamed manufacturers, comply with requirements in Section 012500 "Substitution Procedures" for substitutions for convenience.

C. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:

1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 013300 "Submittal Procedures."

1. Form of Approval of Submittal: As specified in Section 013300 "Submittal Procedures."
2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

C. Submittal Requirements, Two-Step Process: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Owner's portion of the Work.
6. Coordination of Owner-installed products.
7. Progress cleaning.
8. Starting and adjusting.
9. Protection of installed construction.
10. Correction of the Work.

B. Related Requirements:

1. Section 011000 – SUMMARY for coordination of Owner-furnished products , Owner-performed work, Owner's separate contracts, and limits on use of Project site.
2. Section 011200 – SUMMARY OF MULTIPLE PRIMES for coordination of work under separate contracts.
3. Section 013100 – PROJECT MANAGEMENT AND COORDINATION for management and coordination procedures and responsibilities.
4. Section 013300 – SUBMITTAL PROCEDURES for submitting surveys.
5. Section 017700 – CLOSEOUT PROCEDURES for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
6. Section 024119 – SELECTIVE DEMOLITION for demolition and removal of selected portions of the building.
7. Section 078413 – PENETRATION FIRESTOPPING for patching penetrations in fire-rated construction.

1.2 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.3 PREINSTALLATION MEETINGS

A. Cutting and Patching Conference: Conduct conference at Project site.

1. Prior to commencing work requiring cutting and patching, review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting and patching work. Inform Architect of scheduled meeting. Require representatives of each entity directly concerned with cutting and patching to attend, including the following:

a. Contractor's superintendent.
b. Trade supervisor responsible for cutting operations.
c. Trade supervisor(s) responsible for patching of each type of substrate.
d. Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affected by cutting and patching operations.

2. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

B. Layout Conference: Conduct conference at Project site.

1. Prior to establishing layout of [new] [new and existing] perimeter and structural column grid(s), review building location requirements. Review benchmark, control point, and layout and dimension requirements. Inform Architect[and Construction Manager] of scheduled meeting. Require representatives of each entity directly concerned with Project layout to attend, including the following:

a. Contractor's superintendent.
b. Professional surveyor responsible for performing Project surveying and layout.
c. Professional surveyor responsible for performing site survey serving as basis for Project design.

2. Review meanings and intent of dimensions, notes, terms, graphic symbols, and other layout information indicated on the Drawings.
3. Review requirements for including layouts on Shop Drawings and other submittals.
4. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor.

B. Certified Surveys: Submit two copies signed by land surveyor or professional engineer.

C. Certificates: Submit certificate signed by land surveyor or professional engineer, certifying that location and elevation of improvements comply with requirements.

D. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.5 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Professional Engineer Qualifications: Refer to Section 014000 "Quality Requirements."

C. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. General Requirements and Limitations for Cutting and Patching of Work:

a. A Contractor, subcontractor, or sub-subcontractor requiring the cutting of openings in new work installed by others, shall have such openings cut and patched by the trade which installed the work and such cutting and patching shall be at the expense of the Contractor, subcontractor or sub-subcontractor requiring the opening.
b. A Contractor, subcontractor, or sub-subcontractor requiring the cutting of openings or patching of existing materials shall be performed by a sub-contractor with experience in cutting and patching of material being modified and shall be at the expense of the Contractor, subcontractor or sub-subcontractor requiring the opening.
c. Approval to do such cutting and patching shall be received from the Architect prior to proceeding with the work and shall include installation of such reinforcement of the work as the Architect may direct.
d. All blocking, bracing, reinforcement, or structural enhancement required due to cutting and patching shall be provided at no additional cost to Owner. All patching work shall match adjacent existing work unless otherwise noted.

2. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
3. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:

a. Primary operational systems and equipment.
b. Fire separation assemblies.
c. Air or smoke barriers.
d. Fire-suppression systems.
e. Plumbing piping systems.
f. Mechanical systems piping and ducts.
g. Control systems.
h. Communication systems.
i. Fire-detection and -alarm systems.
j. Conveying systems.
k. Electrical wiring systems.

l. Operating systems of special construction.

4. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:

   a. Water, moisture, or vapor barriers.
   b. Membranes and flashings.
   c. Exterior curtain-wall construction.
   d. Sprayed fire-resistive material.
   e. Equipment supports.
   f. Piping, ductwork, vessels, and equipment.
   g. Noise- and vibration-control elements and systems.

5. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner. possible, retain original Installer or fabricator to cut and patch exposed Work listed below. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm.

   a. Processed concrete finishes.
   b. Ornamental metal.
   c. Preformed metal panels.
   d. Roofing.
   e. Firestopping.
   f. Window wall system.
   g. Stucco and ornamental plaster.
   h. Finished wood flooring.
   i. Wall covering.
   j. HVAC enclosures, cabinets, or covers.

D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with requirements specified in other Sections.

1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.

C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Cutting and Patching: Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

C. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

D. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
2. List of detrimental conditions, including substrates.

3. List of unacceptable installation tolerances.
4. Recommended corrections.

E. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect in accordance with requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Architect promptly.

B. Engage a land surveyor or professional engineer experienced in laying out the Work, using the following accepted surveying practices:

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

3.5 INSTALLATION

A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb, and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.

F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels exceeding 80 dba.

G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of Work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements in Section 011000 "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of

uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Each Prime Contractor shall do cutting and patching in existing work or work already constructed required for the work involved in their Contract. Patch holes or openings left by him to match the unaltered existing construction:
1. In Work already constructed, lintels and structural supports required to maintain structural integrity shall be provided by the Contractor whose work requires the opening.
2. Cutting of holes, installation of curbs and temporary, weatherproof and secured enclosures for penetrations through the existing Work shall be the responsibility of the Prime Contractor whose work requires the penetration. Actual roof flashing and associated work must be executed by a subcontractor, hired by the Prime Contractor, who is acceptable to the manufacturer of the existing roof which shall be certified, in writing, to the Owner and Architect/Engineer by the manufacturer. Existing warranty/guarantee shall be certified as remaining valid.
3. For penetrations through new work, the Prime Contractor whose work requires the penetration, shall be responsible to provide the General Contractor of location, size and configuration required for the penetration well in advance of the scheduled work. Prime Contractor who requires penetrations through the new roof construction shall provide the prefabricated roof curb and temporary, weatherproof and secured enclosure on top of curb.

J. Each Prime Contractor shall employ skilled and experienced installer to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.

K. Each Prime Contractor shall submit written request in advance of cutting or altering elements affecting:
1. Structural integrity of element.
2. Integrity of weather-exposed or moisture-resistant elements.
3. Efficiency, maintenance or safety of element.
4. Visual qualities of sight-exposed elements.
5. Work of Owner or separate contractor.

L. Should conditions of work or the schedule indicate a change of products from original installation, each Prime Contractor shall submit request for substitution as specified in Section 01 60 00.
1. Inspect existing conditions of project, including elements subject to damage or to movement during cutting and patching.
2. After uncovering work, inspect conditions affecting installation of products or performance of work.
3. Report unsatisfactory or questionable conditions to Architect/ Engineer, in writing; do not proceed with Work until Architect/Engineer has provided further instructions.

M. Each Prime Contractor shall submit written notice to Architect designating the date and time the work will be uncovered.
   1. Provide adequate temporary support as necessary to assure structural value or integrity of affected portion of work.
   2. Provide devices and methods to protect other portions of project from damage.
   3. Provide protection from elements for that portion of the project exposed by cutting and patching work and maintain excavations free from water.

N. Each Prime Contractor shall execute cutting, fitting and patching including excavation and fill, to complete Work and to:
   1. Make its several parts fit together properly.
   2. Uncover portions of the work to provide for installation of ill-timed work.
   3. Remove and replace defective work.
   4. Remove and replace work not conforming to requirements of the Contract Documents.
   5. Remove samples of installed work as specified for testing.
   6. Provide routine penetrations of non-structural surfaces for installation of piping and electrical conduit.

O. Each Prime Contractor shall execute Work by avoiding damage to other work, and providing proper surfaces to receive patching and finishing.

P. Each Prime Contractor shall execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

Q. Each Prime Contractor shall restore Work with new products in accord with requirements of Contract Documents.

R. Each Prime Contractor shall fit Work airtight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.

S. Each Prime Contractor shall maintain integrity of wall, ceiling or floor construction; completely seal voids.

T. Each Prime Contractor shall refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.

U. Each Prime Contractor shall identify hazardous substance or condition exposed during the Work to the Architect for decision or remedy.
   1. Lead-Based Paint Disturbance: Each Prime Contractor shall be responsible for lead-based paint disturbance precautions. Painted and varnished surfaces must be assumed to be coated with lead-based paint. When these surfaces are disturbed, that disturbance shall be conducted in accord with the Environmental Protection Agency (EPA) 40 CFR, Part 745 “Lead, Renovation,

V. Repair and Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 COORDINATION OF OWNER'S PORTION OF THE WORK

A. Site Access: Provide access to Project site for Owner's construction personnel and Owner's separate contractors.

1. Provide temporary facilities required for Owner-furnished, Contractor-installed and Owner-furnished, Owner-installed products.
2. Refer to Section 011000 "Summary" for other requirements for Owner-furnished, Contractor-installed and Owner-furnished, Owner-installed products.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel and Owner's separate contractors.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel and Owner's separate contractors at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 PROGRESS CLEANING

A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

    a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically

recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls" and Section 017419 "Construction Waste Management and Disposal."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.

C. Comply with manufacturer's written instructions for temperature and relative humidity.

3.11 CORRECTION OF THE WORK

A. Repair or remove and replace damaged, defective, or nonconforming Work. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.

C. Restore permanent facilities used during construction to their specified condition.

D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION

FORM CWM-1: CONSTRUCTION WASTE IDENTIFICATION							
MATERIAL CATEGORY	GENERATION POINT	EST. QUANTITY OF MATERIALS RECEIVED* (A)	EST. WASTE - % (B)	TOTAL EST. QUANTITY OF WASTE* (C = A X B)	EST. VOLUME CY (CM)	EST. WEIGHT TONS (TONNES)	REMARKS AND ASSUMPTIONS
Packaging: Cardboard							
Packaging: Boxes							
Packaging: Plastic Sheet or Film							
Packaging: Polystyrene							
Packaging: Pallets or Skids							
Packaging: Crates							
Packaging: Paint Cans							
Packaging: Plastic Pails							
Site-Clearing Waste							
Masonry or CMU							
Lumber: Cut-Offs							
Lumber: Warped Pieces							
Plywood or OSB (scraps)							
Wood Forms							
Wood Waste Chutes							
Wood Trim (cut-offs)							
Metals							
Insulation							
Roofing							
Joint Sealant Tubes							
Gypsum Board (scraps)							
Carpet and Pad (scraps)							
Piping							
Electrical Conduit							
Other:							

* Insert units of measure.

FORM CWM-2: DEMOLITION WASTE IDENTIFICATION				
MATERIAL DESCRIPTION	EST. QUANTITY	EST. VOLUME CY (CM)	EST. WEIGHT TONS (TONNES)	REMARKS AND ASSUMPTIONS
Asphaltic Concrete Paving				
Concrete				
Brick				
CMU				
Lumber				
Plywood and OSB				
Wood Paneling				
Wood Trim				
Miscellaneous Metals				
Structural Steel				
Rough Hardware				
Insulation				
Roofing				
Doors and Frames				
Door Hardware				
Windows				
Glazing				
Acoustical Tile				
Carpet				
Carpet Pad				
Demountable Partitions				
Equipment				
Cabinets				
Plumbing Fixtures				
Piping				
Piping Supports and Hangers				
Valves				
Sprinklers				
Mechanical Equipment				
Electrical Conduit				
Copper Wiring				
Light Fixtures				
Lamps				
Lighting Ballasts				
Electrical Devices				
Switchgear and Panelboards				
Transformers				
Other:				

FORM CWM-3: CONSTRUCTION WASTE REDUCTION WORK PLAN						
MATERIAL CATEGORY	GENERATION POINT	TOTAL EST. QUANTITY OF WASTE TONS (TONNES)	DISPOSAL METHOD AND QUANTITY			HANDLING AND TRANSPORTION PROCEDURES
			EST. AMOUNT SALVAGED TONS (TONNES)	EST. AMOUNT RECYCLED TONS (TONNES)	EST. AMOUNT DISPOSED TO LANDFILL TONS (TONNES)	
Packaging: Cardboard						
Packaging: Boxes						
Packaging: Plastic Sheet or Film						
Packaging: Polystyrene						
Packaging: Pallets or Skids						
Packaging: Crates						
Packaging: Paint Cans						
Packaging: Plastic Pails						
Site-Clearing Waste						
Masonry or CMU						
Lumber: Cut-Offs						
Lumber: Warped Pieces						
Plywood or OSB (scraps)						
Wood Forms						
Wood Waste Chutes						
Wood Trim (cut-offs)						
Metals						
Insulation						
Roofing						
Joint Sealant Tubes						
Gypsum Board (scraps)						
Carpet and Pad (scraps)						
Piping						
Electrical Conduit						
Other:						

FORM CWM-4: DEMOLITION WASTE REDUCTION WORK PLAN						
MATERIAL CATEGORY	GENERATION POINT	TOTAL EST. QUANTITY OF WASTE TONS (TONNES)	DISPOSAL METHOD AND QUANTITY			HANDLING AND TRANSPORTION PROCEDURES
			EST. AMOUNT SALVAGED TONS (TONNES)	EST. AMOUNT RECYCLED TONS (TONNES)	EST. AMOUNT DISPOSED TO LANDFILL TONS (TONNES)	
Asphaltic Concrete Paving						
Concrete						
Brick						
CMU						
Lumber						
Plywood and OSB						
Wood Paneling						
Wood Trim						
Miscellaneous Metals						
Structural Steel						
Rough Hardware						
Insulation						
Roofing						
Doors and Frames						
Door Hardware						
Windows						
Glazing						
Acoustical Tile						
Carpet						
Carpet Pad						
Demountable Partitions						
Equipment						
Cabinets						
Plumbing Fixtures						
Piping						
Supports and Hangers						
Valves						
Sprinklers						
Mechanical Equipment						
Electrical Conduit						
Copper Wiring						
Light Fixtures						
Lamps						
Lighting Ballasts						
Electrical Devices						
Switchgear and Panelboards						
Transformers						
Other:						

FORM CWM-5: COST/REVENUE ANALYSIS OF CONSTRUCTION WASTE REDUCTION WORK PLAN								
MATERIALS	TOTAL QUANTITY OF MATERIALS (VOL. OR WEIGHT) (A)	EST. COST OF DISPOSAL (B)	TOTAL EST. COST OF DISPOSAL (C = A x B)	REVENUE FROM SALVAGED MATERIALS (D)	REVENUE FROM RECYCLED MATERIALS (E)	LANDFILL TIPPING FEES AVOIDED (F)	HANDLING AND TRANSPORTATION COSTS AVOIDED (G)	NET COST SAVINGS OF WORK PLAN (H = D+E+F+G)
Packaging: Cardboard								
Packaging: Boxes								
Packaging: Plastic Sheet or Film								
Packaging: Polystyrene								
Packaging: Pallets or Skids								
Packaging: Crates								
Packaging: Paint Cans								
Packaging: Plastic Pails								
Site-Clearing Waste								
Masonry or CMU								
Lumber: Cut-Offs								
Lumber: Warped Pieces								
Plywood or OSB (scraps)								
Wood Forms								
Wood Waste Chutes								
Wood Trim (cut-offs)								
Metals								
Insulation								
Roofing								
Joint Sealant Tubes								
Gypsum Board (scraps)								
Carpet and Pad (scraps)								
Piping								
Electrical Conduit								
Other:								

FORM CWM-6: COST/REVENUE ANALYSIS OF DEMOLITION WASTE REDUCTION WORK PLAN								
MATERIALS	TOTAL QUANTITY OF MATERIALS (VOL. OR WEIGHT) (A)	EST. COST OF DISPOSAL (B)	TOTAL EST. COST OF DISPOSAL (C = A x B)	REVENUE FROM SALVAGED MATERIALS (D)	REVENUE FROM RECYCLED MATERIALS (E)	LANDFILL TIPPING FEES AVOIDED (F)	HANDLING AND TRANSPORTATION COSTS AVOIDED (G)	NET COST SAVINGS OF WORK PLAN (H = D+E+F+G)
Asphaltic Concrete Paving								
Concrete								
Brick								
CMU								
Lumber								
Plywood and OSB								
Wood Paneling								
Wood Trim								
Miscellaneous Metals								
Structural Steel								
Rough Hardware								
Insulation								
Roofing								
Doors and Frames								
Door Hardware								
Windows								
Glazing								
Acoustical Tile								
Carpet								
Carpet Pad								
Demountable Partitions								
Equipment								
Cabinets								
Plumbing Fixtures								
Piping								
Supports and Hangers								
Valves								
Sprinklers								
Mech. Equipment								
Electrical Conduit								
Copper Wiring								
Light Fixtures								
Lamps								
Lighting Ballasts								
Electrical Devices								
Switchgear and Panelboards								
Transformers								
Other:								

FORM CWM-7: CONSTRUCTION WASTE REDUCTION PROGRESS REPORT								
MATERIAL CATEGORY	GENERATION POINT	TOTAL QUANTITY OF WASTE TONS (TONNES) (A)	QUANTITY OF WASTE SALVAGED		QUANTITY OF WASTE RECYCLED		TOTAL QUANTITY OF WASTE RECOVERED TONS (TONNES) (D = B + C)	TOTAL QUANTITY OF WASTE RECOVERED % (D / A x 100)
			ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (B)	ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (C)		
Packaging: Cardboard								
Packaging: Boxes								
Packaging: Plastic Sheet or Film								
Packaging: Polystyrene								
Packaging: Pallets or Skids								
Packaging: Crates								
Packaging: Paint Cans								
Packaging: Plastic Pails								
Site-Clearing Waste								
Masonry or CMU								
Lumber: Cut-Offs								
Lumber: Warped Pieces								
Plywood or OSB (scraps)								
Wood Forms								
Wood Waste Chutes								
Wood Trim (cut-offs)								
Metals								
Insulation								
Roofing								
Joint Sealant Tubes								
Gypsum Board (scraps)								
Carpet and Pad (scraps)								
Piping								
Electrical Conduit								
Other:								

FORM CWM-8: DEMOLITION WASTE REDUCTION PROGRESS REPORT								
MATERIAL CATEGORY	GENERATION POINT	TOTAL QUANTITY OF WASTE TONS (TONNES) (A)	QUANTITY OF WASTE SALVAGED		QUANTITY OF WASTE RECYCLED		TOTAL QUANTITY OF WASTE RECOVERED TONS (TONNES) (D = B + C)	TOTAL QUANTITY OF WASTE RECOVERED % (D / A x 100)
			ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (B)	ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (C)		
Asphaltic Concrete Paving								
Concrete								
Brick								
CMU								
Lumber								
Plywood and OSB								
Wood Paneling								
Wood Trim								
Miscellaneous Metals								
Structural Steel								
Rough Hardware								
Insulation								
Roofing								
Doors and Frames								
Door Hardware								
Windows								
Glazing								
Acoustical Tile								
Carpet								
Carpet Pad								
Demountable Partitions								
Equipment								
Cabinets								
Plumbing Fixtures								
Piping								
Supports and Hangers								
Valves								
Sprinklers								
Mechanical Equipment								
Electrical Conduit								
Copper Wiring								
Light Fixtures								
Lamps								
Lighting Ballasts								
Electrical Devices								
Switchgear and Panelboards								
Transformers								
Other:								

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous demolition and construction waste.
2. Recycling nonhazardous demolition and construction waste.
3. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:

1. Section 011200 – MULTIPLE CONTRACT SUMMARY for coordination of responsibilities for waste management.
2. Section 024119 – SELECTIVE DEMOLITION for disposal requirements of waste resulting from partial demolition of buildings, structures, and site improvements.
3. Section 042000 – UNIT MASONRY for disposal requirements for masonry waste.

1.3 DEFINITIONS

A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.

C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner's property.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition and construction waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 15 days of date established for the Notice to Proceed.
1. For All Construction: The General Contractor shall develop and implement a Construction Waste Management Plan (CWMP) for the entire project, quantifying by weight, the percentage of waste materials diverted from landfill disposal and meeting the 75 percent by weight criteria. All Contractors and Subcontractors are required to pay for and dispose of all their construction waste in accordance with the CWMP and its provisions throughout demolition activities.

1.6 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Each Contractor shall submit monthly waste management reports to the General Contractor. Each month, the General Contractor shall compile the data from all Contractors and, concurrent with each Application for Payment, submit report. Use Form CWM-7 for construction waste and Form CWM-8 for demolition waste. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons.
4. Quantity of waste salvaged, both estimated and actual in tons.
5. Quantity of waste recycled, both estimated and actual in tons.
6. Total quantity of waste recovered (salvaged plus recycled) in tons.
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

G. Qualification Data: For waste management coordinator.

H. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.7 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, or individual employed and assigned by General Contractor, with a record of successful waste management coordination of projects with similar requirements. Superintendent may serve as Waste Management Coordinator.

B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

C. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.

D. Waste Management Conference(s): Conduct conference(s) at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan including responsibilities of each contractor and waste management coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.8 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing and construction waste generated by the Work. Use Form CWM-1 for construction waste and Form CWM-2 for demolition waste. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use Form CWM-3 for construction waste and Form CWM-4 for

demolition waste. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there were no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Use Form CWM-5 for construction waste and Form CWM-6 for demolition waste. Include the following:

1. Total quantity of waste.
2. Estimated cost of disposal (cost per unit). Include transportation and tipping fees and cost of collection containers and handling for each type of waste.
3. Total cost of disposal (with no waste management).
4. Revenue from salvaged materials.
5. Revenue from recycled materials.
6. Savings in transportation and tipping fees by donating materials.
7. Savings in transportation and tipping fees that are avoided.
8. Handling and transportation costs. Include cost of collection containers for each type of waste.
9. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of [50] [75] <Insert number> percent by weight of total nonhazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including but not limited to the following:

1. Demolition Waste:

    a. Asphalt paving.
    b. Concrete.
    c. Concrete reinforcing steel.

d. Brick.
e. Concrete masonry units.
f. Wood studs.
g. Wood joists.
h. Plywood and oriented strand board.
i. Wood paneling.
j. Wood trim.
k. Structural and miscellaneous steel.
l. Rough hardware.
m. Roofing.
n. Insulation.
o. Doors and frames.
p. Door hardware.
q. Windows.
r. Glazing.
s. Metal studs.
t. Gypsum board.
u. Acoustical tile and panels.
v. Carpet.
w. Carpet pad.
x. Demountable partitions.
y. Equipment.
z. Cabinets.
aa. Plumbing fixtures.
bb. Piping.
cc. Supports and hangers.
dd. Valves.
ee. Sprinklers.
ff. Mechanical equipment.
gg. Refrigerants.
hh. Electrical conduit.
ii. Copper wiring.
jj. Lighting fixtures.
kk. Lamps.
ll. Ballasts.
mm. Electrical devices.
nn. Switchgear and panelboards.
oo. Transformers.

2. Construction Waste:

a. Masonry and CMU.
b. Lumber.
c. Wood sheet materials.
d. Wood trim.
e. Metals.
f. Roofing.
g. Insulation.
h. Carpet and pad.

i. Gypsum board.
j. Piping.
k. Electrical conduit.
l. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

1) Paper.
2) Cardboard.
3) Boxes.
4) Plastic sheet and film.
5) Polystyrene packaging.
6) Wood crates.
7) Wood pallets.
8) Plastic pails.

m. Construction Office Waste: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following construction office waste materials:

1) Paper.
2) Aluminum cans.
3) Glass containers.

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged and recycled.
2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Sale or Donation: Permitted on Project site.

C. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area on-site, designated by Owner.
5. Protect items from damage during transport and storage.

D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

E. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

F. Plumbing Fixtures: Separate by type and size.

G. Lighting Fixtures: Separate lamps by type and protect from breakage.

H. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.3 RECYCLING, DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Owner.

C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

    a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

3.4 RECYCLING DEMOLITION WASTE

A. Asphalt Paving: Grind asphalt to maximum 1-1/2-inch size.

1. Crush asphaltic concrete paving and screen to comply with requirements in Section 312000 "Earth Moving" for use as general fill.

B. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.

C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

1. Pulverize concrete to maximum 1-1/2-inch size.

D. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.

1. Pulverize damaged masonry to maximum 1-1/2-inch size.
2. Clean and stack undamaged, whole masonry units on wood pallets.

E. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

F. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

G. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.

H. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

I. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

J. Metal Suspension System: Separate metal members, including trim and other metals from acoustical panels and tile, and sort with other metals.

K. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.

1. Store clean, dry carpet and pad in a closed container or trailer provided by carpet reclamation agency or carpet recycler.

L. Carpet Tile: Remove debris, trash, and adhesive.

1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by carpet reclamation agency or carpet recycler.

M. Piping: Reduce piping to straight lengths and store by material and size. Separate supports, hangers, valves, sprinklers, and other components by material and size.

N. Conduit: Reduce conduit to straight lengths and store by material and size.

O. Lamps: Separate lamps by type and store according to requirements in 40 CFR 273.

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

D. Paint: Seal containers and store by type.

3.6 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged or recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

3.7 ATTACHMENTS

A. Form CWM-1 for construction waste identification.

B. Form CWM-2 for demolition waste identification.

C. Form CWM-3 for construction waste reduction work plan.

D. Form CWM-4 for demolition waste reduction work plan.

E. Form CWM-5 for cost/revenue analysis of construction waste reduction work plan.

F. Form CWM-6 for cost/revenue analysis of demolition waste reduction work plan.

G. Form CWM-7 for construction waste reduction progress report.

H. Form CWM-8 for demolition waste reduction progress report.

END OF SECTION

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.

B. Related Requirements:

1. Section 012900 "Payment Procedures" for requirements for Applications for Payment for Substantial Completion and Final Completion.
2. Section 013233 "Photographic Documentation" for submitting Final Completion construction photographic documentation.
3. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
4. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
5. Section 017900 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.2 DEFINITIONS

A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of cleaning agent.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest-control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items required by other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number.
5. Submit testing, adjusting, and balancing records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
6. Advise Owner of changeover in utility services.

7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements.
10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:

1. Submit a final Application for Payment in accordance with Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.
5. Submit Final Completion photographic documentation.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor, listed by room or space number.
2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

a. Project name.
b. Date.
c. Name of Architect.
d. Name of Contractor.
e. Page number.

4. Submit list of incomplete items in the following format:
a. PDF Electronic File: Architect will return annotated file. Use CSI Form 14.1A.

B. Time for completion of incomplete items: Responsible contractor shall complete punchlist items within 15 days after the date established for Substantial Completion.

1.9 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1. Submit by email to Architect and Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

    a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
    b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
    d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    e. Remove snow and ice to provide safe access to building.
    f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    g. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    h. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.
    i. Vacuum and mop concrete.
    j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
    k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
    l. Remove labels that are not permanent.
    m. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

n. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
q. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
r. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
s. Clean strainers.
t. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste-disposal requirements in Section 017419 "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations required by Section 017300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory manuals.
2. Emergency manuals.
3. Systems and equipment operation manuals.
4. Systems and equipment maintenance manuals.
5. Product maintenance manuals.

B. Related Requirements:

1. Section 011200 "Multiple Contract Summary" for coordinating operation and maintenance manuals covering the Work of multiple contracts.
2. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
3. Section 019113 "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.

1.2 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.3 CLOSEOUT SUBMITTALS

A. Initial Submittal: Submit 3 draft copies of each manual at least 21 days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Architect will return 1 copy of draft and mark whether general scope and content of manual are acceptable.

B. Final Submittal: Submit 3 copies of each manual in final form at least 21 days before final inspection. Architect will return copy with comments within 15 days after final inspection.

1. Correct or modify each manual to comply with Architect's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Architect's comments.

C. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.4 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

    a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, an] subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment. Enclose title pages and directories in clear plastic sleeves.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

1.5 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.

3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.6 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:

1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.7 EMERGENCY MANUALS

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

E. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

1.8 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.

9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

C. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

D. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

1.9 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and

service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.

C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

    a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of maintenance manuals.

1.10 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

E. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record specifications.
3. Record Product Data.

B. Related Requirements:

1. Section 011200 "Multiple Contract Summary" for coordinating Project Record Documents covering the Work of multiple contracts.
2. Section 017300 "Execution" for final property survey.
3. Section 017700 "Closeout Procedures" for general closeout procedures.
4. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set of marked-up record prints.

B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and Contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

1.3 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.

b. Record data as soon as possible after obtaining it.
c. Record and check the markup before enclosing concealed installations.
d. Cross-reference record prints to corresponding photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Depths of foundations.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.
j. Changes made by Change Order or Construction Change Directive.
k. Changes made following Architect's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:

a. Project name.
b. Date.
c. Designation "PROJECT RECORD DRAWINGS."
d. Name of Architect.
e. Name of Contractor.

1.4 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation, where installation varies from that indicated in Specifications, addenda, and Contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

B. Format: Submit record specifications as annotated PDF electronic file.

1.5 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

B. Format: Submit Record Product Data as annotated PDF electronic file.

1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

1.6 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file.

1.7 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Instruction in operation and maintenance of systems, subsystems, and equipment.
2. Demonstration and training video recordings.

1.2 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
2. Provide approved final Operations and Maintenance Manuals for use during the training sessions.

B. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.3 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Schedule training only after all systems have been tested and are fully operational.

1.4 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.5 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

1. HVAC systems, including air-handling equipment, air distribution systems and terminal equipment and devices.
2. HVAC instrumentation and controls.
3. Electrical service and distribution system.
4. Packaged engine generators, including transfer switches.
5. Lighting equipment and controls.
6. Communication systems, including equipment. Inter-communication, clocks and programming voice and data and television.
7. Food Service Equipment
8. Fire suppression system
9. Plumbing systems
10. Equipment
11. Finishes

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.

b. Systems and equipment operation manuals.
c. Systems and equipment maintenance manuals.
d. Product maintenance manuals.
e. Project Record Documents.
f. Identification systems.
g. Warranties and bonds.
h. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

a. Instructions on meaning of warnings, trouble indications, and error messages.
b. Instructions on stopping.
c. Shutdown instructions for each type of emergency.
d. Operating instructions for conditions outside of normal operating limits.
e. Sequences for electric or electronic systems.
f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

a. Startup procedures.
b. Equipment or system break-in procedures.
c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.

c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning.
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

1.6 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

1.7 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
1. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season. Schedule training with Owner, through Architect, with at least fourteen days advance notice. Start up and commission of systems must be completed before scheduling instructional session.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.8 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera.

1. Submit video recordings on thumb drive to Owner within 10 days of training session.
2. File Hierarchy: Organize folder structure and file locations according to Project Manual table of contents. Provide complete screen-based menu.
3. File Names: Utilize file names based on name of equipment generally described in video segment, as identified in Project specifications.
4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the equipment demonstration and training recording that describes the following for each Contractor involved on the Project, arranged according to Project Manual table of contents:

    a. Name of Contractor/Installer.
    b. Business address.
    c. Business phone number.
    d. Point of contact.
    e. Email address.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION

SECTION 018109 – TESTING FOR INDOOR AIR QUALITY

PART 1 – GENERAL

1.1 SUMMARY

A. General: This section provides requirements for Baseline Indoor Air Quality (IAQ) Testing for maximum indoor pollutant concentrations for acceptance of the facility.

B. Indoor Air Quality Testing (IAQ Testing): The Owner's Testing Agency shall conduct this testing outside of the Construction Contract and must provide a copy of the report documenting the results of IAQ testing. This IAQ testing shall be conducted with the cooperation of, and in coordination with, the GC, HVAC, EC and PC.

1.2 RELATED SECTIONS

A. Coordinate with Commissioning activities specified in Section 019113 "General Commissioning Requirements".

B. Coordinate with Division 23 Section "Testing, Adjusting and Balancing".

1.3 SUBMITTALS

A. Baseline IAQ Testing: Submit a report for each test site specified for IAQ baseline testing as prescribed herein below and in Division 23 "Testing, Adjusting, and Balancing." Report on air concentrations of targeted pollutants identified in Subsection 3.1 of this section.

1.4 SEQUENCING AND SCHEDULING

A. Identify, program, and schedule all IAQ testing well in advance of completing construction in a manner to prevent delays to the performance of the work of this Contract in order to perform and complete all testing after the completion of construction activities and prior to occupancy.

PART 2 – PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 BASELINE IAQ TESTING

A. HVAC System Verification: To assure compliance with recognized standards for indoor air quality including ASHRAE Standard 62.1-2004, the HVAC Contractor shall verify the performance of each HVAC system prior to IAQ Testing, including space temperature and space humidity uniformity, outside air quantity, filter installation, drain pan operation, and any obvious contamination sources.

B. Indoor Air Quality Testing: Upon verification of HVAC system operation the Owner may, at its discretion, hire an independent contractor to test levels of indoor air contaminants for compliance with specified requirements.

1. A test plan shall be submitted to all Contractors for coordination with their activities. The plan shall specify procedures, times, instrumentation, and sampling methods that will be employed.
2. Conduct baseline IAQ testing using testing protocols consistent with the United States Environmental Protection Agency Compendium of Methods for the Determination of Air Pollutants in Indoor Air.
3. Perform IAQ testing for at least the minimum number of required sampling locations, determined as follows: For each portion of the building served by a separate ventilation system, the number of sampling points shall not be less than one per 25,000 sq. ft., or for each contiguous floor area, whichever is larger, and include areas with the least ventilation as calculated by Ventilation Rate Procedure of ASHRAE Standard 62.1-2004 and greatest presumed source strength as identified by Owner.
    a. Verify areas to be tested with the Owner's Representative. Areas with 100% outside air ventilation rates, such as laboratories, are excluded from these testing requirements. The Owner's Representative is the sole judge of areas exempt from testing.
4. Perform IAQ testing following the completion of all interior construction activities and prior to occupancy. The building shall have all interior finishes installed, including but not limited to millwork, doors, paint, carpet and acoustic tiles. Perform testing prior to installation of furniture, workstation components, and casework.
5. Perform IAQ testing within the breathing zone, between 3’-0” and 6’-0” above the finished floor and over a minimum 4-hour period.
6. Collect air samples during normal occupied hours (prior to occupancy) with the building ventilation system starting at the daily normal start times and operated at the minimum outside air flow rate for the occupied mode throughout the duration of the air testing.
7. Sample and record outside air levels of formaldehyde and TVOC contaminants at three outside air locations (as determined by Owner) simultaneously with indoor tests to establish basis of comparison for these contaminant levels by averaging the three outdoor readings for each contaminant.
8. Perform airborne mold and mildew sampling to identify species present with simultaneous indoor and outdoor readings.
9. Acceptance of respective portions of the building by the Owner is subject to compliance with specified limits of indoor air quality contaminant levels.

C. Compliance Indoor air quality shall conform to the following standards and limits:
1. Carbon Monoxide: Not to exceed 9 ppm.
2. Carbon Dioxide: Not to exceed 530 ppm higher than outdoor ambient levels.
3. Airborne Mold and Mildew: Indoor species distribution cannot vary by more than 10% from exterior sampling speciation.
4. Maximum Air Concentration Standards: Indoor room air concentration levels, emission rates, and qualities of the listed contaminants shall not exceed the limits specified in Table 3.1 below.

D. Test Reports: Prepare test reports showing the results and location of each test, a summary of the HVAC operating conditions, a listing of any discrepancies and recommendations for corrective actions, if required.
    1. Include certification of test equipment calibration with each test report.

E. For each sampling point where the maximum concentration limits listed in Table 3.1 are exceeded, the HVAC Contractor is responsible for conducting additional flush-out with outside air and retesting the specific parameter(s) exceeded to indicate the requirements are achieved. Repeat procedure until all requirements have been met. When retesting non-complying building areas, take samples from the same locations as in the first test. Retesting shall be performed at no additional expense to the Owner.

Table 3.1 MAXIMUM INDOOR AIR CONCENTRATION STANDARDS

Indoor Contaminants	Maximum Concentration
Formaldehyde	50 parts per billion
Total Particulates (PM10)	50 micrograms per cubic meter
Total Volatile Organic Compounds (TVOC)	500 micrograms per cubic meter
4-Phenylcyclohexene (4-PCH)*	6.5 micrograms per cubic meter
Carbon Monoxide (CO)	9 parts per million and no greater than 2 parts per million above outdoor levels

* This test is only required if carpets and fabrics with styrene butadiene rubber (SBR) latex backing material are installed as part of the base building systems.

END OF SECTION

SECTION 019113 – GENERAL COMMISSIONING REQUIREMENTS

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes:
1. Commissioning: Commissioning is a systematic process involving the Commissioning Agent (CA), the Testing Adjusting and Balancing professional (TAB), the Contractors, the Architect, Manufacturer and other entities to ensure that selective building systems perform interactively according to the design intent and the Owner's operational needs. This is achieved by beginning in the design phase and documenting design intent and continuing through construction, acceptance, and the warranty period with actual verification of performance. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training.
2. Commissioning during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:
    a. Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
    b. Verify and document proper performance of equipment and systems.
    c. Verify that O&M documentation left on site is complete.
    d. Verify that the Owner's operating personnel are adequately trained.
    e. The commissioning process does not take away from or reduce the responsibility of the Contractor to meet the Contract Documents.
3. Related Sections include the following:
    a. General Conditions, Article 9.8, for definition of Substantial Completion.

4. The requirements of the General Conditions, the Supplementary General Conditions, and the applicable portions of Division 1, General Requirements shall apply to this section of the specifications.
5. Separate commissioning services (Commissioning Agent) have been established directly with the Owner. The Commissioning Agent will lead the commissioning process, The Commissioning Team and will have overall responsibility for planning and coordinating the commissioning process. The Owner, Architect, Engineer, and all Prime Contractors will all have responsibilities for commissioning and shall be included in the commissioning team. Each responsibility is identified elsewhere in this document.
6. Commissioning is an ongoing process and shall be performed throughout construction. Commissioning shall conclude with the completion of all required testing, training and system documentation as specified and required to ensure the proper operation of the equipment and systems.
7. Project Commissioning Requirements:
    a. The following systems are to be inspected, tested, signed off as complete and operational, and operated for the commissioning agent:
        i. HVAC Systems Including ATC System

ii. Plumbing Systems
iii. Electrical Systems
iv. System Verification Checklist (SVC):
    1. System Verification Checklists shall be defined as follows: a checklist that is used by the Commissioning Agent as approved by the commissioning team to document that each component / system is installed completely and correctly. This checklist is to included, but not be limited to the proper installation of piping, duct, electrical, controls (Including all Graphics), communications, fixtures, components, devices, interfaces, etc. as required to make each system complete.
    2. The SVC shall be developed and provided by the Commissioning Agent, similar to system checklists included in the AABC Commissioning Guideline. Contractors shall be responsible to assist the Commissioning Agent, by participating in the completion of the System Verification Checklist(s) for each system identified above.
v. Functional Performance Testing Checklist:
    1. Functional Performance Testing Checklist shall be defined as follows: a checklist that completely documents the full range of checks and tests carried out to determine if all components, subsystems, systems and interfaces between systems function in accordance with the Contract Documents. In this context, “function” includes all modes and sequences of control operation, all interlocks and conditional control responses, and all specified responses to emergency conditions in all seasons modes. The Commissioning Agent shall define the testing scope and document the results.
    2. All associated subcontractors are to participate in the Functional Performance Testing, as defined above and support the Commissioning Agent / Commissioning Team as required to confirm each component / system(s) are complete

1.2 ABBREVIATIONS

A. Abbreviations: The following are common abbreviations used in the Specifications and in the Commissioning Plan. Definitions are found in Article 1.7.

A/E Architect and Design Engineers	GC General Contractor
BMS Building Management System	HC HVAC Contractor
CA Commissioning authority	IC Installing Contractor
CC Construction checklist	PC Plumbing Contractor
Cx Commissioning	
Cx Plan Commissioning Plan Document	Subs Subcontractors or Sub-subcontractors
EC Electrical Contractor	TAB Testing, Adjusting & Balancing
ATCC Automatic Temperature Control Contractor	

1.3 DEFINITIONS

A. Acceptance Phase - phase of construction after startup and initial checkout when functional performance tests, O&M documentation review and training occur.

B. Approval - acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes according to the Contract Documents.

C. Architect / Engineer (A/E) - the Owner's design consultants who comprise the design team, including the HVAC mechanical designer/engineer and the electrical designer/engineer.

D. Owner's Project Requirements - The Owner's Project Requirements is the documentation of the primary thought processes and assumptions behind design decisions that were made to meet the design intent. The Owner's Project Requirements describes the systems, components, conditions, and methods chosen to meet the intent. Some reiterating of the design intent may be included.

E. Commissioning Authority (CA) - The CA directs and coordinates the day-to-day commissioning activities. The CA does not take an oversight role.

F. Commissioning Plan - an overall plan, developed after bidding that provides the structure, schedule and coordination planning for the commissioning process.

G. Construction Checklist (CC) - a list of items to inspect and elementary component tests to conduct to verify proper installation of equipment/work; provided by the CA to each Contractor. Construction checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels OK, labels affixed, gages in place, sensors calibrated, etc.). However, some construction checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three-phase pump motor of a chiller system). Construction Checklists are used prior to functional testing. Construction checklists augment and are combined with the manufacturer's start-up checklist and the specified equipment checkout sheet(s). Even without a commissioning process, contractors typically perform some, if not many, of the construction checklist items a commissioning authority will recommend. However, few contractors document in writing the execution of these checklist items. Therefore, for most equipment, the contractors execute the checklists on their own. The commissioning authority only requires that the procedures be documented in writing and does not witness much of the completion of construction checklists, except for larger or more critical pieces of equipment.

H. Contract Documents - the documents binding on parties involved in the construction of this project (drawings, specifications, change orders, amendments, contracts, etc.).

I. Control system - the central building energy management control system.

J. Data logging - monitoring flows, currents, status, pressures, etc. of equipment using stand-alone data loggers separate from the control system.

K. Deferred Functional Tests – FTs that are performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions that prevent the test from being performed.

L. Deficiency - a condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents.

M. Design Intent - a dynamic document that provides the explanation of the ideas, concepts and criteria that are considered to be very important to the owner. It is initially the outcome of the programming and conceptual design phases.

N. Factory Testing - testing of equipment on-site or at the factory by factory personnel with a Project Manager present.

O. Functional Performance Test (FT) - test of the dynamic function and operation of equipment and systems using manual (direct observation), trending or remote monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water testing, adjusting and balancing (TAB) is not functional testing, in the commissioning sense of the word. The TAB Agency's primary work is setting up the system flows and pressures as specified, while functional testing is verifying that which has already been set up. The Commissioning Authority develops the functional test procedures in a sequential written form, coordinates, oversees and documents the actual testing, which is usually performed by the installing contractor or vendor. FTs are performed after construction checklists and start-up activities are complete.

P. Indirect Indicators - indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100% closed.

Q. Installing Contractor – contractor who installs specific equipment and/or systems.

R. R. Manual Test - using hand-held instruments, immediate control system readouts or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the "observation").

S. Monitoring - the recording of parameters (flow, current, status, pressure, etc.) of equipment operation using data loggers or the trending capabilities of control systems.

T. Non-Compliance - see Deficiency.

U. Non-Conformance - see Deficiency.

V. Over-written Value - writing over a sensor value in the control system to see the response of a system (e.g., changing the outside air temperature value from 50F to 75F to verify economizer operation). See also “Simulated Signal.”

W. Owner-Contracted Tests - tests paid for by the Owner outside the contract and for which the CA does not oversee. These tests will not be repeated during functional tests if properly documented.

X. Phased Commissioning - commissioning that is completed in phases (by floors, for example) due to the size of the structure or other scheduling issues, in order to minimize the total construction time.

Y. Sampling. - Functionally testing only a fraction of the total number of identical or near identical pieces of equipment. Refer to Subparagraph 3.4-F.8 for details.

Z. Seasonal Performance Tests – Functional tests that are deferred until the system(s) will experience conditions closer to their design conditions.

AA. Simulated Condition - condition that is created for the purpose of testing the response of a system (e.g., applying a hair blower to a space sensor to see the response in a VAV box).

BB. Simulated Signal - disconnecting a sensor and using a signal generator to send an amperage, resistance or pressure to the transducer and DDC system to simulate a sensor value.

CC. Specifications - the construction specifications of the Contract Documents.

DD. Startup - the initial starting or activating of dynamic equipment, including executing construction checklists.

EE. Subs - Subcontractors or Sub-subcontractors who furnish and install building components and systems.

FF. Test Procedures - the step-by-step process, which must be executed to fulfill the test requirements. The CA develops the test procedures.

GG. Test Requirements - requirements specifying what modes and functions, etc. shall be tested. The test requirements are not the detailed test procedures.

HH. Trending - monitoring using the building management system.

II. Vendor - supplier of equipment.

JJ. Warranty Period - warranty period for entire project, including equipment components. Warranty begins at Substantial Completion and extends for at least the duration specified.

KK. ATCC, FMS, ATC refers to the HVAC control subcontractor, vendor or manufacturer, and installer of the HVAC control systems.

1.4 COORDINATION

A. A. Commissioning Team. The members of the commissioning team consist of the CA, the Contractors, the Architect and Design Engineers (particularly the Mechanical Engineer), the TAB representative, and the ATC/FMS contractor and other installing Subs or suppliers of equipment or work that is part of systems to be commissioned. If known, the Owner's building or plant operator/engineer is also a member of the commissioning team.

B. Management. The CA directs and coordinates the commissioning activities and reports to the Architect. All members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents.

C. Scheduling. The CA will work with the Contractors according to established protocols to schedule the commissioning activities. The CA will provide sufficient notice to the Contractors for scheduling commissioning activities. Each Contractor shall provide scheduling information for his commissioning activities to the GC. The GC, with assistance from the CA, shall coordinate and integrate all commissioning activities into the master Project Construction Schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.
    1. The CA will provide the initial schedule of primary commissioning events at the initial commissioning meeting. The Commissioning Plan will provide a format for this schedule. As construction progresses and more detailed schedules are available from the Contractors, the CA will adjust the commissioning schedule accordingly

1.5 COMMISSIONING PROCESS

A. Commissioning Plan. The Commissioning Plan will be developed and provided by the CA after certain information is received from and coordinated between the Contractors. The Cx Plan shall be binding on the Contractors. The Cx Plan provides guidance in the execution of the commissioning process. The Specifications will take precedence over the Commissioning Plan.

B. Commissioning Process. The following narrative provides a brief overview of the minimum and typical commissioning tasks during construction and the general order in which they occur.
    1. Commissioning during construction begins with an initial Commissioning meeting conducted by the CA where the commissioning process is reviewed with the commissioning team members.
    2. Additional meetings will be required throughout construction, scheduled by the CA with necessary parties attending, to plan, coordinate, schedule future activities and resolve problems.
    3. Equipment documentation is distributed by the Architect to the CA during the normal submittal process, including manufacturers' detailed start-up procedures.
    4. The CA works with each Contractor in developing startup plans and documentation formats, including providing each Contractor with construction checklists to be completed during the startup process.

5. In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with construction checklists being completed before functional testing.
6. The Contractors, under their own direction, execute and document the construction checklists and perform startup and initial checkout. The CA documents that the checklists and startup were completed according to the approved plans. This may include the CA witnessing startup of selected equipment. Refer to Article 3.2.
7. The CA develops specific equipment and system functional performance test procedures. The Contractors review the procedures. Refer to Article 3.4.
8. The functional testing and procedures are executed by the Contractors, under the direction of and documented by the CA. Refer to Article 3.4.
9. Items of non-compliance in material, installation or setup are corrected by the Contractors at the Contractors' expense and the system retested. Refer to Articles 3.2, 3.4 & 3.5.
10. The CA reviews the O&M documentation for completeness.
11. Except for deferred/ seasonal testing, the project will not be considered substantially complete until the conclusion of Commissioning functional testing procedures as defined in the Cx Plan and Contract Documents.
12. The CA reviews, pre-approves and coordinates the training provided by the Contractors and verifies that it was completed. Refer to Article 3.7.
13. Deferred testing is conducted, as specified or required. Refer to Article 3.8.
14. The entire process must be witnessed by the Architect and the independent Testing, Adjusting, and Balancing contractor.

1.6 RESPONSIBILITIES

A. The responsibilities of various parties in the commissioning process are provided in this Section 019113 and in Divisions 21, 22, 23, 26, 27, and 28. Services and responsibilities of the A/E and CA as set forth in these documents are included for the Contractors' reference and information. Responsibilities will be similarly listed in the Commissioning Plan.
    1. Where field commissioning activities require the participation of multiple Contractors and other entities, the CA will assign the appropriate Prime Contractor to be responsible for coordinating the completion of the checklists. As with other aspects of construction, the Contractors shall cooperate and coordinate accordingly with all entities involved.

B. All Parties:
    1. Follow the Commissioning Plan.
    2. Attend an initial commissioning meeting and additional meetings, as necessary.

C. All Contractors:
    1. Construction and Acceptance Period:
        a. Facilitate coordination of the commissioning work by the CA, and with the GC and Architect, ensure that commissioning activities are being scheduled into the master Project Construction Schedule.
        b. Include the cost of commissioning activities pertinent to the Contract in the bid.
        c. In each purchase order or subcontract written, include requirements for submittal data, O&M data, commissioning tasks and training.

d. Ensure that all sub-contractors execute their commissioning responsibilities according to the Contract Documents and schedule.
e. Contractor's representative, subcontractors, and vendors shall attend the initial commissioning meeting and other commissioning meetings scheduled by the Architect and CA to facilitate the Cx process unless such presence is not necessary as determined by the Architect.
f. Coordinate and schedule the training of owner personnel through Architect.
    i. Prepare O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.
g. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.
h. Assist in equipment testing per agreements with sub-contractors.
i. Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to the Contract Documents.
j. Provide DVD recordings with audio of the training sessions for Owner's personnel, cataloged in an approved format, and submitted with the O&M manuals.
k. Provide information requested by the CA and Architect regarding equipment sequence of operation and testing procedures.
    i. Review test procedures for equipment installed by factory representatives.
    ii. Provide instruction and demonstration for the Owner's designated operation and maintenance staff, in conjunction with the commissioning agent and mechanical engineer, and with the participation of qualified technicians from major equipment suppliers.
    iii. Notify the Commissioning Agent a minimum of two weeks in advance of scheduled equipment and system startups, to allow witness by the commissioning team.
    iv. Provide sufficient personnel to assist the commissioning as required during system verification and functional performance testing.
    v. Prior to startup, inspect, check and confirm the correct and complete installation of all equipment and systems for which system verification checklists are included in the commissioning plan. Support the Commissioning Agent in the process of documenting the results of all inspections, testing and checks.
    vi. Notify the Commissioning Agent a minimum of two weeks in advance of the time for start of the TAB work. Attend the initial TAB meeting for review of the TAB procedures.
    vii. Provide equipment and system startup resources as specified and as required. If during an attempted equipment or system startup, deficient or incomplete work is discovered that would prelude safe operation, the startup shall be aborted until corrective action has been taken. Ensure such action is taken and verified before rescheduling a new startup.
    viii. Carry out performance checks to ensure that all equipment and systems are fully functional and ready for the commissioning team to witness formal functional performance testing.

ix. Provide a schedule to identify the activities when O&M manuals, training sessions, duct and pipe cleaning/flushing, equipment startup, TAB activities and any other tasks important to the commissioning process.
x. Update drawings for as-built condition and review with the commissioning team.
xi. Assemble O&M manuals on all equipment and submit to the Engineer.
xii. Participate in and schedule vendor equipment O&M staff training.
xiii. Notify the Commissioning Agent, in writing, when all equipment and systems are complete.
xiv. Assist the Independent Commissioning Agent hired by the Owner to complete the System Verification Checklists and the Functional Performance Testing Checklists.

2. Warranty Period:
    1. Ensure that Subcontractors execute seasonal or deferred functional performance testing, witnessed by the CA, according to the specifications.

D. Ensure that Subcontractors correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

E. Owner:
1. Develop and commit to the Owner's Program for the facility and its use.
2. Support the Commissioning Program, including commissioning meeting attendance.
3. Assign operations and maintenance personnel to participate in various commissioning meetings, observations/inspections, and training sessions.
4. Review and approve any changes made to the design intent or the construction documents.
5. Review and comment on the Commissioning System Verification checklists and Functional Performance Testing.
6. Review and accept the Commissioning Report.

F. Architect / Engineer:
1. Provide documentation of basis of design from the information received from Owner's Requirements.
2. Support the Commissioning Program, including commissioning meeting attendance.
3. Provide contract documents outlining system design parameters and revisions to the initial basis of design as necessary, after obtaining approval by the Owner.
4. Prepare contract documents and include Commissioning Agent supplied Commissioning Specification.
5. Attend construction coordination meetings and perform site inspections of installation for compliance with the contract documents.
6. Review contractor submittals for compliance with the contract documents.
7. Review TAB procedures submitted by the TAB Contractor.
8. Review system verification checklist and functional performance test procedures.
9. Review and accept TAB report and final Commissioning Report.
10. Review and approve any changes made to the design intent or the construction documents.
11. After reviewing commissioning activities coordinate the commissioning schedule with contractors and incorporate it into the construction schedule prepared by the GC.

12. Coordinate construction of systems and equipment. Ensure that installing contractors perform all installation requirements and commissioning responsibilities.
13. Process the following to the Owner:
    a. Shop drawings
    b. As-built drawings
    c. Manufacturer's Operation and Maintenance Manuals
    d. Manufacturer's service contracts
    e. Test and balance reports
14. The Architect is the coordinator of the commissioning team's efforts and shall work closely with the Commissioning Agent to ensure the success of the commissioning process, including commissioning meeting attendance.

G. Commissioning Agent:
1. Support the Commissioning Program.
2. The Commissioning Agent shall support the Owner, Architect/Engineer and the Construction Administrator to ensure the success of the commissioning program including leading the commissioning meetings.
3. Shall complete a submittal review and provide any comments to the Architect/Engineers.
4. The Commissioning Agent shall develop and complete the System Verification Checklists and the Functional Performance Testing Checklists.
5. Perform and documents field inspections to confirm correct equipment/system installation.
6. Chair commissioning meetings, as required and provide meeting minutes to the commissioning team.
7. Perform system verification of completeness and document the results on the System Verification Checklists.
8. Witness and documents equipment/system startup.
9. Perform, with the assistance of the responsible contractors, and document the functional testing of each system. The results documented on the associated Functional Performance Test Checklists.
10. Perform and document trending, with the assistance of the ATC contractor.
11. Coordinate and participate in owner training.
12. Inspect and confirm the complete assembly of accurate O&M manuals.
13. Process the following to the Construction Administrator:
    1. Approved Commissioning Plan
    2. Completed System Verification Checklists
    3. Completed Functional Testing Reports.
    4. Final Commissioning Report.

H. TAB Contractor:
1. This contractor shall support the Commissioning Agent to ensure the success of the commissioning program, including commissioning meeting attendance.
2. Submit TAB procedures to the Commissioning Agent and the commissioning team for review and acceptance.
3. Process the following to the Commissioning Agent:
    a. Air balance sheets
    b. Water balance sheets

4. This subcontractor shall include in their quote the cost of participating in the commissioning process.
5. Provide instruction and demonstration for the Owner's designated operation and maintenance staff, in conjunction with the commissioning agent and mechanical engineer, and with the participation of qualified technicians.
6. Notify the Commissioning Agent a minimum of two weeks in advance of scheduled system startups, to allow witness by the commissioning team.
7. Provide sufficient personnel to assist the commissioning as required during system verification and functional performance testing.
8. Support the Commissioning Agent in the process of documenting the results of all inspections, testing and checks.
9. Carry out performance checks to ensure that all equipment and systems are fully functional and ready for the commissioning team to witness formal functional performance testing.
10. Provide a schedule to identify when TAB activities and any other tasks important to the commissioning process.
11. Notify the Commissioning Agent, in writing, when all TAB work is completed.
12. Include 10% Commissioning Agent directed spot checks for both air and water. These checks can be for any systems selected by the Commissioning Agent.

1.7 SYSTEMS TO BE COMMISSIONED

A. The commissioning program shall include but is not limited to the following systems, equipment, components for complete system verification including the following:

HVAC SYSTEMS		PLUMBING SYSTEMS
1. Building Automation System		1. Domestic Hot Water System
2. Chillers		2. Building Energy Meters
3. Boilers		3. Domestic Water Preheater
4. Air Handling Units		
5. Packaged Air Handling Units		
6. Packaged Rooftop Air Handling Units		ELECTRICAL SYSTEMS
7. Computer Room Air Conditioners		1. Emergency Generator
8. Dedicated Outdoor Air Systems		2. Transfer Switches
9. Hot Water Distribution Systems		3. Automatic Load Transfer System (Substation)
10. Chiller Water Distribution Systems		4. Lighting & Lighting Controls
11. VAV Terminal Units		5. Communication & Paging Systems
12. Exhaust Fans		6. Building Energy Meters
13. Glycol Systems		
14. Convectors		
15. Cabinet Heaters		
16. Unit Heaters		
17. Heat Recovery Systems		
18. Building Energy Meters		
19. Fire Smoke Dampers		

1.8 REFERENCE STANDARDS

B. AABC – Associated Air Balancing Council (AABC) Commissioning Guideline.

C. ASHRAE – Guideline 1-1996 The HVAC Commissioning Process.

D. SMACNA – HVAC Systems Commissioning Manual

1.9 COORDINATION AND COOPERATION

A. Installing Contractor responsible for Work under Divisions 22, 23 and 26 shall provide commissioning support as described in this document and as included in the design documents.

PART 2 – PRODUCTS

2.1 TEST EQUIPMENT

A. All testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Installing Contractor for the equipment being tested, unless indicated otherwise. For example, the HC shall be responsible for all testing equipment for the HVAC system and controls except for equipment specific to and used by the TAB Agency for its responsibilities. The Installing Contractor shall provide two-way radios for use during testing by its personnel and the CA.

B. Special equipment, tools and instruments (only available from vendor; specific to a piece of equipment) required for testing equipment according to the Contract Documents shall be included in the base bid price and shall be turned over to and become the property of the Owner.

C. Temporary data logging equipment and software required to test equipment will be provided by the CA, but shall not become the property of the Owner.

D. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to accuracy of 0.5°F and a resolution of + or - 0.1°F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

E. Refer to Section 019113, Part 3 for details regarding equipment that may be required to simulate required test conditions.

F. The installing contractor shall coordinate and provide any equipment necessary for access to all systems to accomplish commissioning tasks.

PART 3 – EXECUTION

3.1 TEST EQUIPMENT

A. A. Initial Commissioning Meeting: Within 60 days of commencement of construction, the CA will schedule, plan and conduct a commissioning meeting with the entire commissioning team in attendance. Meeting minutes will be distributed to all parties by the CA. Information gathered from this meeting will allow the CA to further develop, maintain and revise the Commissioning Plan, which will be distributed to all parties.

B. Progress Commissioning Meetings: Other meetings will be planned and conducted by the CA as construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular Contractors. The CA will plan these meetings and will minimize unnecessary time being spent by Contractors. The commissioning meeting agenda will include, but will not be limited to, a review of latest: design details, submittal status and content, commissioning field reports (generated by the commissioning agent), project schedule, commissioning activities schedule, RFIs, field installation status, equipment access issues, owner training, etc.

C. Typically, these meetings will be held twice per month or as needed to support the schedule of the project.

D. A review of the System Verification Checklists (SVC), Test Adjust and Balancing (TAB) Report information and the Functional Performance Testing Checklists (FPTC) data will be the main focus of the group.

3.2 START-UP, CONSTRUCTION CHECKLISTS AND INITIAL CHECKOUT

A. The following procedures apply to all equipment to be commissioned. Some systems that are not comprised so much of actual dynamic machinery may have very simplified CCs and startup.

B. General: Construction checklists are important to ensure that equipment and systems are hooked up correctly and operational. It ensures that functional performance testing (in-depth system checkout) may proceed without unnecessary delays. Each piece of equipment receives full construction checkout. No sampling strategies are used. The start-up and initial checkout testing for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system.

C. Start-up and Initial Checkout Plan: The CA will assist the commissioning team members responsible for startup of equipment in developing detailed start-up plans for all equipment. The primary role of the CA in this process is to ensure that there is written documentation that each of the manufacturer-recommended procedures have been completed. Parties responsible for construction checklists and startup are identified in the initial commissioning meeting and in the checklist forms.

1. The CA provides construction checklists and procedures from Sections 019113, 230800, 260800, and other applicable specification sections. These checklists indicate required procedures to be executed as part of startup and initial checkout of the systems and the party responsible for their execution.

2. The CA provides these checklists and tests to the appropriate Prime Contractor. Each form will usually have more than one trade responsible for its execution.
3. The Contractor responsible for the purchase of the equipment develops the full start-up plan by combining (or adding to) the CA's checklists with the manufacturer's detailed start-up and checkout procedures from the O&M manual and the normally used field checkout sheets. The plan will include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan.
    a. The full start-up plan could consist of something as simple as:
        i. The CA's construction checklists.
        ii. The manufacturer's standard written start-up procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.
        iii. The manufacturer's normally used field checkout sheets.
4. The Contractor submits the full startup plan to the CA for review and approval.
5. The CA reviews and approves the procedures and the format for documenting them, noting any procedures that need to be added.
6. The CA submits the plan for review and approval by Architect.

D. Sensor and Actuator Calibration:
    1. All field-installed temperature, relative humidity, CO, CO2 and pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated using the methods described below. Alternate methods may be used, if approved by the CA beforehand. All test instruments shall have had a certified calibration within the last 12 months. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.
    2. All procedures used shall be fully documented on the construction checklists or other approved forms, clearly referencing the procedures followed and written documentation of initial, intermediate and final results.
    3. Sensor Calibration Methods:
        a. All Sensors: Verify that all sensor locations are appropriate and away from causes of erratic operation. Verify that sensors with shielded cable are grounded only at one end. For sensor pairs that are used to determine a temperature or pressure difference, make sure they are reading within 0.2°F of each other for temperature and within a tolerance equal to 2% of the reading, of each other, for pressure. Tolerances for critical applications may be tighter.
        b. Sensors Without Transmitters - Standard Application: Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or building management system (BMS)) is within the tolerances in the table below of the instrumentmeasured value. If not, install offset in BMS, calibrate or replace sensor.
        c. Sensors With Transmitters - Standard Application: Disconnect sensor. Connect a signal generator in place of sensor. Connect ammeter in series between transmitter and BMS control panel. Using manufacturer's resistancetemperature data simulate minimum desired temperature. Adjust transmitter potentiometer zero until the ammeter reads 4 mA. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the BMS. Record all values and recalibrate controller as necessary to conform to specified control ramps, reset

schedules, proportional relationship, reset relationship and P/I reaction. Reconnect sensor. Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or building management system (BMS)) is within the tolerances in the table below of the instrument measured value. If not, replace sensor and repeat. For pressure sensors, perform a similar process with a suitable signal generator.

d. Critical Applications. For critical applications, more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.

4. Tolerances, Standard Applications:

Sensor	**Required Tolerance (+/-)**	**Sensor**	**Required Tolerance (+/-)**
Cooling coil, chilled water temps	0.4F	Flow rates, water Relative humidity	4% of design 4% of design
AHU wet bulb or dew point	2.0F	Combustion flue temps	5.0F
Hot water coil and boiler water temp	1.5F	Oxygen or CO2 monitor	0.1 % pts
Outside air, space air, duct air temps	0.4F	CO monitor	0.01 % pts
Watthour, voltage & amperage	1% of design	Natural gas flow rate	1% of design
Pressures, air, water and gas	3% of design		3% of design
Flow rates, air	10% of design	Barometric pressure	0.1 in. of Hg

5. Valve and Damper Stroke Setup and Check:
    a. BMS Readout. For all valve and damper actuator positions checked, verify the actual position against the BMS readout.
    b. Set pumps or fans to normal operating mode. Command valve or damper closed, visually verify that valve or damper is closed and adjust output zero signal as required. Command valve or damper open, verify position is full open and adjust output signal as required. Command valve or damper to a few intermediate positions. If actual valve or damper position doesn't reasonably correspond, replace actuator or add pilot position indicator (for pneumatics).
    c. Closure for heating coil valves (NO): Set heating setpoint 20°F above room temperature. Observe valve open. Remove control air or power from the valve and verify that the valve stem and actuator position do not change. Restore to normal. Set heating setpoint to 20°F below room temperature. Observe the valve close. For pneumatics, by override in the BMS, increase pressure to valve by 3 psi (do not exceed actuator pressure rating) and verify valve stem and actuator position does not change. Restore to normal.
    d. Closure for cooling coil valves (NC): Set cooling setpoint 20°F above room temperature. Observe the valve close. Remove control air or power from the valve and verify that the valve stem and actuator position do not change. Restore to normal. Set cooling setpoint to 20°F below room temperature. Observe valve open. For pneumatics, by override in the BMS, increase pressure to valve by 3 psi (do not exceed actuator pressure rating) and verify valve stem and actuator position does not
    e. change. Restore to normal.

E. Execution of Construction Checklists and Startup:
    1. Four weeks prior to startup, the Contractor shall schedule startup and checkout with the CA and other pertinent entities. Performance of construction checklists, startup and checkout are directed and executed by the Contractor or vendor. When checking off construction checklists, signatures may be required of other Contractors for verification of completion of their work.
    2. The CA will, at its discretion, observe, at minimum, the procedures for each piece of primary equipment, unless there are multiple units. In no case will the number of units witnessed be less than four on any one building, nor less than 20% of the total number of identical or very similar units.
    3. For lower-level components of equipment (e.g.: sensors, controllers), the CA will observe a sampling of the construction and start-up procedures. The sampling procedures will be identified in the Commissioning Plan.
    4. The Contractors shall execute startup and provide the CA with a signed and dated copy of the completed start-up and construction tests and checklists.
    5. Only installing individuals that have direct knowledge that a line item task on the construction checklist was actually performed shall initial or check that item off.

F. Deficiencies, Non-Conformance and Approval in Checklists and Startup:
    1. The Contractor shall clearly list any outstanding items of the initial start-up and construction procedures that were not completed successfully, at the bottom of each procedures form or on an attached sheet. Each procedures form and any outstanding deficiencies shall be submitted to the CA within two days of test completion.
    2. The CA reviews each report and submits either a non-compliance report or an approval form to the Contractor. The CA shall work with the Contractor to correct and retest deficiencies or uncompleted items. The CA will involve the Contractor and others as necessary. The installing Contractors shall correct all items that are deficient or incomplete in the checklists and tests in a timely manner, notify the CA as soon as outstanding items have been corrected, and resubmit an updated startup report and Statement of Correction on each original noncompliance report.
    3. Items left incomplete, which later cause deficiencies or delays during functional testing may result in backcharges to the responsible party.

3.3 PHASED COMMISSIONING

A. If the project is a phased project it requires startup and initial checkout to be executed in phases, phasing will be planned and scheduled in a coordination meeting of the CA, Contractors, TAB Agency and ATCC. Results shall be added to the master Project Construction Schedule and the CA's commissioning schedule.

3.4 FUNCTIONAL PERFORMANCE TESTING

A. This article applies to all commissioning functional testing.

B. The general list of equipment and systems to be commissioned is found in this Section.

C. The parties responsible to execute each test are listed with each test in Sections 230800, 260800 and other sections.

D. Objectives and Scope: The objective of functional performance testing is to demonstrate that each system is operating according to the Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.
    1. In general, each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested. Specific modes required in this project are given in Sections 230801, 260801 and other sections.

E. Development of Test Procedures: Before test procedures are written, the CA shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. Using the testing parameters and requirements in Sections 230800, 260800 and other sections, the CA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Each Contractor or vendor responsible to execute a test shall provide limited assistance to the CA in developing the procedures review (answering questions about equipment, operation, sequences, etc.). Prior to execution, the CA shall provide a copy of the test procedures to the Contractors who shall review the tests for feasibility, safety, equipment and warranty protection.
    1. The CA shall review selective Owner-contracted factory testing or required Owner acceptance tests which the CA is not responsible to oversee, including documentation format, and shall determine what further testing or format changes may be required to comply with the Specifications. Redundancy of testing shall be minimized.
    2. The purpose of any given specific test is to verify and document compliance with the stated criteria of acceptance given on the test form.
    3. The test procedure forms developed by the CA shall include (but not be limited to) the following information:
        a. System and equipment or component name(s)
        b. Equipment location and ID number
        c. Unique test ID number, and reference to unique construction checklist and start-up documentation ID numbers for the piece of equipment
        d. Date
        e. Project name
        f. Participating parties
        g. A copy of the specific sequence of operations or other specified parameters being verified
        h. Formulas used in any calculations
        i. Required pre-test field measurements
        j. Instructions for setting up the test.
        k. Special cautions, alarm limits, etc.
        l. Specific step-by-step procedures to execute the test, in a clear, sequential and repeatable format

m. Acceptance criteria of proper performance with a Yes / No check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.
n. A section for comments
o. Signatures and date block for the CA

F. Test Methods:
1. Functional performance testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by stand-alone data loggers. Division 23, 26, 27 and 28 Sections and other sections specify which methods shall be used for each test. The CA may substitute specified methods or require an additional method to be executed, other than what was specified. The CA will determine which method is most appropriate for tests that do not have a method specified.
2. Simulated Conditions: Simulating conditions (not by an overwritten value) shall be allowed, though timing the testing to experience actual conditions is encouraged wherever practical.
3. Overwritten Values: Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value or by altering the appropriate set point to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.
4. Simulated Signals: Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.
5. Altering Setpoints: Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the AC compressor lockout work at an outside air temperature below 55F, when the outside air temperature is above 55F, temporarily change the lockout setpoint to be 2F above the current outside air temperature.
Indirect Indicators: Relying on indirect indicators for responses or performance shall
6. be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification is completed during startup and initial checkout testing.
7. Setup: Each function and test shall be performed under conditions that simulate actual conditions as close as is practically possible. The Contractor executing the test shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Contractor shall return all affected building equipment and systems, due to these temporary modifications, to their pre-test condition.
8. Sampling: Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference.

Specific recommended sampling rates are specified with each type of equipment in Sections 230800, 260800. No sampling by Contractors is allowed in executing Construction Checklists for startup and initial checkout.

a. A common sampling strategy referenced in the Specifications as the "xx% Sampling—yy% Failure Rule" is defined by the following example.
    i. xx = the percent of the group of identical equipment to be included in each sample.
    ii. yy = the percent of the sample that if failing, will require another sample to be tested.
b. The example below describes a 20% Sampling—10% Failure Rule.
    i. Randomly test at least 20% (xx) of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitute the "first sample."
    ii. If 10% (yy) of the units in the first sample fail the functional performance tests, test another 20% of the group (the second sample).
    iii. If 10% of the units in the second sample fail, test all remaining units in the whole group.
    iv. If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the CA may stop the testing and require the Contractor to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.

G. Coordination and Scheduling: The Contractors shall provide sufficient notice to the CA regarding their completion schedule for the Construction Checklists and startup of all equipment and systems. The CA will schedule functional tests with the Contractors and inform the A/E when they will occur. The CA shall direct, witness and document all functional testing of equipment and systems. The Contractors shall execute the tests.
    1. In general, functional testing shall be conducted after construction and startup has been satisfactorily completed. The control system shall be sufficiently tested and approved by the CA before it is used for TAB or to verify performance of other components or systems. The air balancing and water balancing shall be completed and debugged before functional testing of air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.

H. Test Equipment: Refer to Section 019113, Part 2 for test equipment requirements.

I. Problem Solving: The CA will recommend solutions to problems found, however the burden of responsibility to solve, correct and retest problems is with the Contractors and A/E.

3.5 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

A. Documentation. The CA shall witness and document the results of all functional performance tests using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the Contractors for review. The CA shall provide written report of all issues and action plan for resolving any items.

B. Non-Conformance:
   1. The CA will record the results of the functional test on the procedure or test form. All deficiencies or non-conformance issues shall be noted and reported to the A/E on a standard non-compliance form.
   2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CA. In such cases the deficiency and resolution will be documented on the procedure form.
   3. Every effort shall be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so at the request of the Owner.
   4. As tests progress and a deficiency is identified, the CA discusses the issue with the executing Contractor.
      a. When there is no dispute on the deficiency and the Contractor accepts responsibility to correct it:
         i. The CA documents the deficiency and the Contractor's response and intentions, and they go on to another test or sequence. After the day's work, the CA submits the non-compliance reports to the A/E for signature, if required. A copy is provided to the Contractor and CA. The Contractor corrects the deficiency, signs the statement of correction at the bottom of the non-compliance form certifying that the equipment is ready to be retested and sends it back to the CA.
         ii. The Contractor reschedules the test and coordinates with CA to establish a time and date that the test is to be repeated.
      b. If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:
         i. The deficiency shall be documented on the non-compliance form with the Contractor's response and a copy given to the A/E and to the Contractor representative assumed to be responsible.
         ii. Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the A/E. Final acceptance authority is with the A/E.
         iii. The CA documents the resolution process.
         iv. Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, signs the statement of correction on the non-compliance form and provides it to the CA. The Contractor reschedules the test and notifies the CA of the date and time the test is to be repeated. This will occur until satisfactory performance is achieved.
   5. Cost of Retesting:
      a. The cost for the Contractor to retest a startup/checkout or functional test, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the responsible parties.
      b. For a deficiency identified, not related to any construction checklist or start-up fault, the following shall apply: The CA will direct the retesting of the equipment once at no "charge" to the Contractor for the CA's time. However, the CA's time for a second retest will be charged to the Contractor, who may choose to recover costs from the responsible Sub.
      c. The time for the CA to direct any retesting required because a specific construction checklist or start-up test item, reported to have been successfully completed, but

determined during functional testing to be faulty, will be backcharged to the Contractor, who may choose to recover costs from the party responsible for executing the faulty construction test.

d. Refer to "sampling" subparagraph 3.4-F.8 of this Section for requirements for testing and retesting identical equipment.

6. The Contractor shall respond in writing to the CA at least as often as commissioning meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.
7. The CA retains the original non-conformance forms until the end of the project.
8. Any required retesting by any Contractor shall not be considered a justified reason for a claim of delay or for a time extension by the Contractor.

C. Failure Due to Manufacturer Defect: If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the Owner. In such case, the Contractor shall provide the Owner with the following:

1. Within one week of notification from the A/E, the Contractor shall examine all other identical units making a record of the findings. The findings shall be provided to the A/E within two weeks of the original notice.
2. Within two weeks of the original notification, the Contractor shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions, which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.
3. The A/E will determine whether a replacement of all identical units or a repair is acceptable.
4. Two examples of the proposed solution will be installed by the Contractor and the CA will be allowed to test the installations for up to one week, upon which the CA will decide whether to accept the solution.
5. Upon acceptance, the Contractor and/or manufacturer shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.

D. Approval: The CA notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made later after review by the CA. The CA recommends acceptance of each test to the Owner and A/E using a standard form. The A/E gives final approval on each test using the same form, providing a signed copy to the CA and the Contractor.

3.6 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

O&M Manuals: Specific content and format requirements for the O&M manuals are detailed in Section 017700 and Sections of Divisions 23, 26, 27 and 28. This Section 019113 also specifies some of the O&M manual contents. Special requirements for the ATCC and TAB Agency are found in Section 230800.

A. Each Contractor shall submit operational and maintenance manuals to the Commissioning Agent, prior to training. The Commissioning Agent shall review the O&M manuals, documentation and As-builts for systems that are commissioned to verify compliance with the Specifications. The Commissioning Agent shall provide written feedback on O&M manuals to the Architect for distribution. Upon successful review of the corrections, the Commissioning Agent shall recommend approval and acceptance of these sections. The Commissioning Agent shall review each equipment warranty and verify that all requirements to keep the warranty valid are clearly stated. This work does not supersede the Architect's and Design Engineer's responsibilities according to their contracts.

B. The O&M manuals shall be project specific and include all wiring diagrams and interconnections between trades. O&M manuals must meet at minimum the following checklist before acceptance for each component:
    1. Present manual in a three-ring binder, with table of contents and tabbed sections.
    2. Indicate building name, project title, contractor name and contractor project number must appear on both the front cover and the spine of the binder.
    3. Provide a copy of the valve tag schedule at the front of the O&M manual.
    4. Except for minor equipment, provide complete nameplate information at the front of the O&M. Include all data: serial numbers as well as complete motor nameplate data of corresponding equipment.
    5. Provide a sheet at the beginning of the O&M listing equipment and the local supplier (with address and phone number) of that specific equipment.
    6. For all equipment with warranties in excess of one-year include extended warranty information in the front of the binder.
    7. Include project specific information to not provide generic vendor O&M manuals that cover multiple model numbers of equipment. Edit vendor O&M manuals to reflect exact equipment supplied. Cross out extraneous information not applicable to the specific equipment provided. Highlight applicable information for each piece of equipment installed.
    8. For each piece of equipment, provide complete data relative to the make/model number, size, capacity data, manufacturer name and address and accessories included. (i.e., provide complete information that would allow ordering the exact piece of equipment supplied). To accomplish this, include portions of the approve submittal for the piece of the equipment submitted. Do not include extraneous submittal information that does not facilitate actually ordering that piece of equipment.
    9. If a piece of equipment contains multiple sub-assemblies provided by different manufacturers, include make/model number, size, capacity data to allow the ordering of the exact replacement. For example, for an air-handling unit, provide information on each coil, filter, damper and fan.
    10. Provide job specific, as-built, wiring diagrams, piping diagrams for all equipment. All external connections must be shown on these diagrams. Example: A piece of equipment is supplied with controls that interface with the DDC system. Wiring diagram must be project specific and indicate interface with the DDC system.
    11. For all pumps and fans, include performance curves, accessories and motor manufacturer information.
    12. For all flow elements (pitot tubes, triple duty valves, circuit setters, etc.) provide all flow curves.
    13. For all air-handling systems, include sound power data.
    14. For all filters provide clean and dirty filter drops.

15. For all electrical equipment provide sensor calibration and setup requirements.
16. Provide a list of all manufacturer spare parts for major equipment installed.
17. Provide an approved copy of the air and water balancing reports.
18. Provide an as-built copy of the project control drawings along with the installation and maintenance information on individual control components.
19. Provide a copy of the equipment vibration test report.
20. For equipment requiring a factory start-up provide a copy of the start-up report.

3.7 TRAINING OF OWNER PERSONNEL

A. The Contractor shall be responsible for coordinating and scheduling training of Owner's personnel through the Architect for the equipment and systems installed by the Contractor, and ultimately for ensuring that training is completed. The training must be verified by the Architect.

B. The CA shall be responsible for overseeing and reviewing the content and adequacy of the training of Owner personnel for commissioned equipment.
   1. The CA shall interview the facility manager and lead engineer to determine the special needs and areas where training will be most valuable. The Owner and CA shall decide how rigorous the training should be for each piece of commissioned equipment. The CA shall communicate the results to the Contractor and vendors who have training responsibilities.
   2. In addition to these general requirements, the specific training requirements of Owner personnel by Contractor and vendors is specified in Divisions 23, 26, 27 and 28.
   3. Each Contractor and vendor responsible for training will submit a written training plan to the CA for review and approval prior to training. The plan will cover the following elements:
      a. Equipment (included in training)
      b. Intended audience
      c. Location of training
      d. Objectives
      e. Subjects covered (description, duration of discussion, special methods, etc.)
      f. Duration of training on each subject
      g. Instructor for each subject
      h. Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.)
      i. Instructor and qualifications
   4. For the primary HVAC equipment, the ATCC shall provide a short discussion of the control of the equipment during the mechanical or electrical training conducted by others.
   5. The CA develops an overall training plan and coordinates and schedules, with the Owner and Contractor, the overall training for the commissioned systems. The CA develops criteria for determining that the training was satisfactorily completed, including attending some of the training, etc. The CA recommends approval of the training to the A/E using a standard form. The A/E also signs the approval form.
   6. At one of the training sessions, the CA will discuss the use of the blank functional test forms for re-commissioning equipment.
   7. The Contractor shall provide digital video-recording with audio of his training sessions for Owner's personnel and submit three copies on a common format disk media, appropriately cataloged and added to the O&M manuals.

8. Subject to Owner's authorization for additional A/E services, the design engineers will at the first training session present the overall system design concepts and the design concepts of each equipment section. This presentation will review all systems, using simplified system schematics (one-line drawings), including chilled water systems, heat rejection systems, heating systems, fuel oil and gas supply systems, supply air systems, exhaust system and outside air strategies.

3.8 DEFERRED TESTING

A. Unforeseen Deferred Tests: If any check or test cannot be completed due to a deficiency in the building structure or other required occupancy condition, execution of checklists and functional testing may be delayed upon approval of the A/E.
   1. These tests will be conducted in the same manner as the seasonal tests as soon as possible. Services of necessary parties will be negotiated.

B. Seasonal Testing: During the warranty period, seasonal testing (tests delayed until weather conditions are closer to the system's design) specified in Section 230800 shall be completed as part of this Contract. The CA shall coordinate this activity. Tests shall be executed, documented and deficiencies corrected by the appropriate Contractor, with Owner's facilities staff and the CA witnessing. Any final adjustments to the O&M manuals and as-builts due to the testing shall be made.

3.9 WRITTEN WORK PRODUCTS

A. The commissioning process generates a number of written work products described in various parts of the Specifications. The Commissioning Plan lists all the formal written work products, describes briefly their contents, who is responsible to create them, their due dates, who receives and approves them and the location of the specification to create them. In summary, the written products are:

Product	Developed By
Commissioning plan	CA
Commissioning meeting minutes	CA
Commissioning schedules	CA with Contractors; GC incorporates in Project Construction Schedule
Equipment documentation submittals	Contractors through CA
Sequence clarifications	Contractors and A/E as needed
Construction checklists	CA with assistance from Contractors
Startup and initial checkout plan	Contractors and CA (Compilation of existing documents)
Startup and initial checkout forms filled out	Contractors
Final TAB report	TAB Agency
Issues log (deficiencies)	CA with responses provided by Contractors
Commissioning Progress Record	CA
Deficiency reports	CA
Functional test forms	CA with assistance from Contractors
Filled out functional tests	CA
O&M manuals	Contractors; review by CA
Commissioning record books & Compact Disks	CA

Overall training plan	CA and Contractors
Specific training agendas	CA and Contractors
Final commissioning report	CA
Misc. approvals	CA
Verification of commissioning	CA

END OF SECTION

SECTION 02.4116 – DEMOLITION

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Remove all items as shown on the Drawings in accordance with the Sequence of Construction.

1.02 SUBMITTALS

A. Submit demolition and removal procedures and schedule.

1.03 EXISTING CONDITIONS

A. Conduct demolition to minimize interference with adjacent building areas. Maintain protected egress and access at all times.

B. Provide, erect, and maintain temporary barriers and security devices.

C. Satisfactorily prevent of control dust resulting from demolition.

D. Comply with the National Emission Standard for Asbestos, as contained in the Federal Register, Volume 38, No. 66.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 PREPARATION

A. Locate existing active utilities and verify whether each utility will remain in service and therefore requires protection or is part of the demolition and removal activity.

B. Protect existing items which are not indicated to be altered.

C. Prior to starting work, make arrangements with the proper authorities for turning off and disconnecting utilities in conjunction with demolition activities. Disconnect, remove, and cap subject utility services. Mark location of disconnected utilities. Identify and indicate capping locations on Project Record Documents.

3.02 EXECUTION

A. Demolish in an orderly and careful manner. Protect any existing structures to remain from damage.

B. Do not disturb existing paving unless it becomes necessary to do so in order to complete other work.

C. Do not, under any circumstances, set fire to structures. Burning of debris shall not be allowed.

D. Remove walls and foundations completely.

E Except where noted otherwise, immediately remove demolished materials from site and properly dispose of materials in accordance with applicable laws.

F. Remove materials to be re-installed or retained in manner to prevent damage.

G. Remove and promptly dispose of contaminated, vermin infested, or dangerous materials encountered.

H. Remove demolished materials from site as work progresses. Upon completion of work, leave areas of work in clean condition.

I. Carefully backfill subsurface and grade to the adjacent ground level. Backfill and grade to ensure proper drainage.

END OF SECTION

SECTION 03.3300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Concrete standards.
2. Concrete materials.
3. Admixtures.
4. Fiber reinforcement
5. Vapor retarders.
6. Floor and slab treatments.
7. Liquid floor treatments.
8. Curing materials.
9. Concrete densifiers
10. Clear Sealer/Topcoat
11. Accessories.
12. Repair materials.
13. Concrete mixture materials.
14. Concrete mixture class types.
15. Concrete mixing.

B. Related Requirements:

1. Section 031000 "Concrete Forming and Accessories" for form-facing materials, form liners, insulating concrete forms, and waterstops.
2. Section 032000 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.
3. Section 312000 "Earth Moving" for drainage fill under slabs-on-ground.
4. Section 321313 "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement or blended hydraulic cement alone or in combination with one or more of the following:

1. Fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

1.4 Water/Cementitious Materials (w/cm) Ratio: The ratio by weight of mixing water to cementitious materials.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete Subcontractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, special procedures for application of concrete densifiers and polyurethane clear sealer/topcoat for the floor slabs, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness; floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection, initial curing of standard-cured and field curing of field-cured test cylinders, protection of field cured field test cylinders, and distribution of test reports.

1.6 ACTION SUBMITTALS

A. Product data: Submit product data for all materials and components used in the Work.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.

2. Compressive strength at 28 days or other age as specified.
3. Compressive strength required at stages of construction.
4. Durability exposure classes for Exposure Categories F, S, W, and C.
5. Maximum w/cm ratio.
6. Slump or slump flow limit.
7. Air content.
8. Nominal maximum aggregate size.
9. Steel-fiber reinforcement content.
10. Intended placement method.
11. Submit adjustments to design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant changes.

C. Shop Drawings:

1. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

2. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

    a. Location of construction joints is subject to approval of the Architect.

3. Contraction Joint Layout: Indicate proposed contraction joint locations.

    a. Location of contraction joints is subject to approval of the Architect.

D. Samples: For vapor retarder.

E. Concrete Schedule: For each location of each class of concrete indicated in "Concrete Mixture Class Types" Article, including the following:

1. Concrete class designation.
2. Location within Project.
3. Exposure class designation.
4. Formed surface finish designation and final finish.
5. Final finish for floors.
6. Floor treatment, if any.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Installer: Include copies of applicable ACI certificates.

2. Testing Agency: Include documentation indicating compliance with ASTM E329 or ASTM C1077 and copies of applicable ACI certificates for testing technicians or ACI Concrete Construction Special Inspector - MH, ASCC.
3. Welding Certificates.

B. Material Certificates: For each of the following:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Form materials and form release agents.
5. Waterstops.
6. Floor and slab treatments.
7. Bonding agents.
8. Adhesives.
9. Vapor retarders.
10. Semirigid joint filler.
11. Joint-filler strips.
12. Repair materials.

C. Material Test Reports: For the following:

1. Portland cement.
2. Blended hydraulic cement.
3. Performance-based hydraulic cement.
4. Fly ash.
5. Slag cement.
6. Silica fume.
7. Natural or other pozzolans.
8. Aggregates.
9. Ground calcium carbonate and aggregate mineral filler.
10. Admixtures.

D. Floor surface flatness and levelness measurements report, indicating compliance with specified tolerances in accordance with ACI 117 and in compliance with ASTM E1155.

E. Research Reports:

1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
2. For sheet vapor retarder, showing compliance with ICC's Acceptance Criteria AC380.

F. Preconstruction Test Reports: For each mix design.

G. Field quality-control reports.

H. Minutes of preinstallation conference.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: A qualified Installer who employs Project personnel qualified as an ACI-certified Concrete Flatwork Associate and Concrete Flatwork Finisher and a supervisor who is a certified ACI Advanced Concrete Flatwork Finisher/Technician or an ACI Concrete Flatwork Finisher with experience installing and finishing concrete.

1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Laboratory Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing that performs duties on behalf of the Architect/Engineer.

1. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I, in accordance with policies from ACI CPP 610.1 or an equivalent certification program. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

D. Field Quality-Control Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for the testing indicated.

1. Personnel conducting field tests on plastic concrete properties are to be qualified as an ACI Concrete Field Testing Technician, Grade 1, in accordance with policies from ACI CPP 610.1 or an equivalent certification program.

E. Mockups: Cast concrete slab-on-ground panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship. Provide up to two batches of concrete to demonstrate the number of required mockups.

1. Slab-on-Ground: Build panel in the location indicated or, if not indicated, as directed by Architect.
    a. Divide panel into four equal panels to demonstrate saw joint cutting.

1.9 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.
   1. Include the following information in each test report:
      a. Admixture dosage rates.
      b. Slump.
      c. Air content.
      d. Seven-day compressive strength.
      e. 28-day compressive strength.
      f. Evaluation of permeability-reducing admixtures.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94 and ACI 301.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

C. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

1.11 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

   1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
   3. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
   5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas

1.12 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement sheet vapor retarder barrier material and accessories for sheet vapor retarder barrier and accessories that do not comply with requirements or that fail to resist penetration by vapor within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CONCRETE STANDARDS

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301.
2. ACI 117.

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, or as detailed.

D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

E. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

F. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

2.5 CONCRETE MATERIALS

A. Source Limitations:
1. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer for the entire Project.

2. Obtain each type of admixture from single source from single manufacturer for the entire Project.

B. Cementitious Materials:

1. Portland Cement: ASTM C 150/C 150M, Type I.
2. Fly Ash: ASTM C 618, Class F.
3. Ground Ganulated Blast-Furnace Slag, ASTM C989, Grade 100 or 120.

C. Normal-Weight Aggregates:

1. Coarse Aggregate: ASTM C33/C33M, Class 3S
2. Maximum Coarse-Aggregate Size: 1 inch (25.4 mm) nominal.
3. Fine Aggregate: ASTM C33/C33M. Free of materials with deleterious reactivity to alkali in cement.

2.6 ADMIXTURES

A. Air-Entraining Admixture: ASTM C260/C260M.

B. Admixtures: The use of admixtures shall be the responsibility of the Contractor. When more than one admixture is used in the mix, furnish satisfactory evidence to the Architect that the admixtures to be used are compatible in combination with the cement and aggregates. Provide only one brand of each type of admixture. Admixtures shall be free of calcium chloride and thiocyanate (not more than 0.05% chloride ions). The following types of admixtures are approved:

1. Air-Entrainment Admixture: Master Builders "MB-AE, Micro Air or MB-VR," W. R. Grace & Co. "Daravair or Darex Series," Sika "Sika Air" or approved equal conforming to ASTM C260.
2. Water Reducing Admixture (Low Range): Master Builders "Pozzolith Series," W. R. Grace & Co. "WRDA, Mira, or ADVA Series," Sika "Plastocrete 161," or approved equal conforming to ASTM C494, Type A.
3. Water Reducing Admixture (High Range): Master Builders "Rheobuild 1000 of Glenium Series," W. R. Grace & Co. "Daracem, Mira, or ADVA Series," Sika "Viscocrete 2100," or approved equal conforming to ASTM C494, Type F.
4. Retarding Admixture: Master Builders "Pozzolith Series or Delvo Series," W. R. Grace & Co. "Daratard Series or Recover," Sika "Plastiment ES" or approved equal conforming to ASTM C494, Type B.
5. Accelerating Admixture: Master Builders "Pozzolith NC 534 or Pozzutec 20+," W. R. Grace & Co. "Daraset Series, DCI, PolarSet, or Lubricon NCA", Sika "SikaSet NC", or approved equal conforming to ASTM C494, Type C.
6. Shrinkage Reducing Admixture: Master Builders "Tetraguard AS20," W.R. Grace & Co. "Eclipse Floor 200 (interior – non-air entrainable) or Eclipse 4500 (exterior – air

entrainable)", Sika "Sika Control 40", or approved equal conforming to ASTM C494, Type S.

7. Corrosion Inhibiting Admixture: Master Builders Rheocrete CNI or Rheocrete 222+, “WR Grace “DCI or DCI-S”, Sika “CNI” or approved equal conforming to ASTM C494 Type S.
8. Calcium Nitrite based with solids content of 30 +/- 2 %. Dosage rate varies between 2 and 4 gallons/cubic yard. Contact manufacturer’s representative for corrosion-protection guidance based on chloride exposure level.

C. Mixing Water for Concrete Mixtures and Water Used to Make Ice: ASTM C1602/C1602M. Include documentation of compliance with limits for alkalis, sulfates, chlorides, or solids content of mixing water from Table 2 in ASTM C1602/C1602M.

2.7 FIBER REINFORCEMENT

A. Carbon-Steel-Wire Fiber: ASTM A820/A820M, Type 1, cold-drawn wire, deformed, minimum of 2 inches (50 mm) long, with an aspect ratio of 45 to 50.

2.8 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A, except with maximum water-vapor permeance of not more than 0.01 gr./sq.ft. complying with ASTM E 1745. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Stego Industries LLC.; Stego Wrap Vapor Barrier, 15 mil.
2. WR Meadows, Inc.; Perminator HP, 15 mil
3. Insulation Solutions, Inc.; Viper Vaporcheck II, 15 mil.

2.9 FLOOR AND SLAB TREATMENTS

A. Slip-Resistive Aluminum Granule Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of not less than 95 percent fused aluminum-oxide granules.

B. Unpigmented Mineral Dry-Shake Floor Hardener: Factory-packaged dry combination of Portland cement, graded quartz aggregate, and plasticizing admixture.

2.10 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

2.11 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

C. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.

1. Color:

a. Ambient Temperature Below 50 deg F (10 deg C): Black.
b. Ambient Temperature between 50 and 85 deg F (10 and 29 deg C): Any color.
c. Ambient Temperature Above 85 deg F (29 deg C): White.

D. Water: Potable water that does not cause staining of the surface.

E. Clear, Waterborne, Membrane-Forming, Curing Compound: ASTM C309, Type 1, Class A, certified by curing compound manufacturer to not interfere with bonding of floor covering.
1. Manufacturer: Sika Corporation, Antisol or approved equivalent curing compound line.
2. Curing compound shall be compatible with subsequent grinding, densifier treatment, and polyurethane sealer.

2.12 CONCRETE DENSIFIER

A. Characteristics:
1. Penetrating, non-film-forming, chemically reactive densifier.
2. Provides surface hardening, dustproofing, reduced porosity, and improved stain resistance.
3. Compatible with polyurethane coatings following proper surface preparation.

B. Product: Sikafloor®-956 LD, lithium silicate concrete densifier.

2.13 POLYURETHANE CLEAR SEALER/TOPCOAT

A. Characteristics:
1. Clear, abrasion-resistant, chemically resistant finish suitable for vehicular traffic areas.
2. Low-VOC.
3. Compatible with densified and mechanically prepared concrete.

B. Product: Sikafloor®-304 W, two-component, water-based aliphatic polyurethane topcoat.

2.14 ACCESSORIES

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 in accordance with ASTM D2240.

C. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C881/C881M, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Reglets: Fabricate reglets of not less than 0.022-inch- thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

F. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

G. Floor Slab Protective Covering: 8 ft wide cellulose fabric.

H. Non-shrink Grout: ASTM C1107; premixed compound consisting of non-metallic aggregate; cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.

2.15 REPAIR MATERIALS

A. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.

2.16 CONCRETE MIXTURE MATERIALS

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301 (ACI 301M).

1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland or hydraulic cement in concrete assigned to Exposure Class F3 as follows:.

1. Fly Ash or Other Pozzolans: 25 percent by mass.
2. Combined Fly Ash and Ground Granulated Blast Furnace Slag: 25 percent.
3. Granulated Blast Furnace Slag: 25 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Admixtures: Use admixtures in accordance with manufacturer's written instructions..

1. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
2. Use permeability-reducing admixture in concrete mixtures where indicated.
3. Use water-reducing or high-range water-reducing admixture in concrete, as required, for placement and workability.
4. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
5. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50

2.17 CONCRETE MIXTURE CLASS TYPES

A. Class A: Normal-weight concrete used for footings, foundation walls ,grade beams , and tie beams.

1. Exposure Class: ACI 318, Class F0, C1.
2. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
3. Maximum w/cm Ratio: 0.45.
4. Slump Limit: 3 inches, plus or minus 1 inch.
5. Air Content:

    a. Exposure Class F0: 3.0 percent, plus or minus 1.0 percent at point of delivery for concrete containing 1inch (25 mm) nominal maximum aggregate size.

B. Class B: Normal-weight concrete used for interior slabs-on-ground.

1. Exposure Class: ACI 318 (ACI 318M) Class F0, C1.
2. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
3. Maximum w/cm Ratio : 0.45.
4. Slump Limit: 4 inches
5. Air Content:

a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.

6. Steel-Fiber Reinforcement: Add to concrete mixture, in accordance with manufacturer's written instructions, at a rate of 50 lb./cu. yd. (29.7 kg/cu. m).

C. Class C: Normal-weight concrete used for exterior retaining walls.

1. Exposure Class: ACI 318 (ACI 318M) Class F2, C2.
2. Minimum Compressive Strength: 4000 psi (24.1 MPa) at 28 days.
3. Air Content:

a. Exposure Classes F2: 5.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch (38-mm) nominal maximum aggregate size.

D. Class D: Normal-weight concrete used for exterior slabs subject to deicing salts.

1. Exposure Class: ACI 318 Class F3,C2.
2. Minimum Compressive Strength: 4000 psi at 28 days
3. Maximum w/cm Ratio: 0.45
4. Air Content: 6.0 percent ±1.5 percent

E. Class E: Normal-weight concrete used for composite floor slabs over metal deck (interior).

1. Exposure Class: ACI 318 Class F1, C1.
2. Minimum Compressive Strength: 4000 psi at 28 days
3. Maximum w/cm Ratio: 0.50
4. Air Content: Not to exceed 3.0 percent
5. Slump: As required for proper placement.

F. Class F: Normal-weight concrete used for interior metal pan stairs and landings:

1. Exposure Class: ACI 318 Class F2.
2. Minimum Compressive Strength: 4000 psi at 28 days.
3. Maximum w/cm Ratio: 0.45.
4. Maximum Size Aggregate: 1/2 inch.
5. Slump Limit: 3 inches, plus 1 inch or minus 2 inches.
6. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery.
7. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

2.18 CONCRETE MIXING.

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M and furnish delivery ticket.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before placing concrete, verify that installation of concrete forms, accessories, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:

1. Daily access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 FORMWORK INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch for smooth-formed finished surfaces.
2. Class C, 1/2 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.

2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement

3.4 TOLERANCES

A. Comply with ACI 117 (ACI 117M).

3.5 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated.

3.6 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.7 SHORING AND RESHORING INSTALLATION

A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.

1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection

3.8 INSTALLATION OF VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.9 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.10 INSTALLATION OF JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
2. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
6. Space vertical joints in walls as indicated on Drawings Unless otherwise indicated on Drawings. Locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.
7. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
8. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:
   1. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch (3-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. If joint pattern is not shown, provide joints not exceeding 15’ in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays) and as approved by the Architect. Consult with Architect prior to locating joints.

E. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

   1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
   2. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface, where joint sealants, specified in Section 07.9200 "Joint Sealants," are indicated.
   3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

F. Doweled Joints:

   1. Install dowel bars and support assemblies at joints where indicated on Drawings.
   2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

3.11 WATERSTOP INSTALLATION

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.12 INSTALLATION OF CAST-IN-PLACE CONCRETE

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses

B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operation.

3.13 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.

1. Apply scratch finish to surfaces indicated, and to receive concrete floor toppings, and if scheduled to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated and exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
    a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

G. Slip-Resistive Finish: Before final floating, apply slip-resistive aluminum granule finish to concrete stair treads, platforms, and ramps, as indicated on Drawings.

1. Apply in accordance with manufacturer's written instructions and as follows:

a. Uniformly spread 25 lb./100 sq. ft. (12 kg/10 sq. m) of dampened slip-resistive aluminum granules over surface in one or two applications.
b. Tamp aggregate flush with surface, but do not force below surface.
c. After broadcasting and tamping, apply float finish.
d. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aluminum granules.

3.14 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish or to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part Portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white Portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.

Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp with fog spray for at least 36 hours.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.15 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases 4 inches high unless otherwise indicated on Drawings and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
3. Minimum Compressive Strength: 4000 psi at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices.

    a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    b. Cast anchor-bolt insert into bases.
    c. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items.

1. Cast-in inserts and accessories, as shown on Drawings.
2. Screed, tamp, and trowel finish concrete surfaces.

3.16 APPLICATION OF CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb./sq. ft. x h, calculated in accordance with ACI 305R, before and during finishing operations.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb./sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Curing Formed Surfaces: Comply with ACI 308.1 (ACI 308.1M) as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
3. If forms remain during curing period, moist cure after loosening forms.
4. If removing forms before end of curing period, continue curing for remainder of curing period as follows:

    a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
    b. Continuous Sprinkling: Maintain concrete surface continuously wet.
    c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
    d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
    e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.

        1) Recoat areas subject to heavy rainfall within three hours after initial application.

2) Recoat areas subject to heavy rainfall within three hours after initial application.
3) Protect treated surface from precipitation, windborne debris, and foot traffic until dry.
4) Maintain continuity of coating and repair damage during curing period.

F. Curing Unformed Surfaces: Comply with ACI 308.1 (ACI 308.1M) as follows:

1. Begin curing after finishing concrete.
2. Interior Concrete Floors:

a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

a) Lap edges and ends of absorptive cover not less than 12 inches (300 mm).
b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive.

a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
b) Cure for not less than seven days.

3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following not in cold weather:

a) Water.
b) Continuous water-fog spray.

b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

a) Lap edges and ends of absorptive cover not less than 12 inches (300 mm).
b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive.

a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
b) Cure for not less than seven days.

3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

a) Water.
b) Continuous water-fog spray.

c. Floors to Receive Polished Finish: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

a) Lap edges and ends of absorptive cover not less than 12 inches (300 mm).
b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

a) Water.
b) Continuous water-fog spray.

d. Floors To Receive Chemical Stain:

1) As soon as concrete has sufficient set to permit application without marring concrete surface, install curing paper over entire area of floor.
2) Install curing paper square to building lines, without wrinkles, and in a single length without end joints.

3) Butt sides of curing paper tight; do not overlap sides of curing paper.
4) Leave curing paper in place for duration of curing period, but not less than 28 days.

e. Floors To Receive Urethane Flooring:

1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
2) Rewet absorptive cover and cover immediately with polyethylene moisture-retaining cover with edges lapped 6 inches (150 mm) and sealed in place.
3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.

f. Floors To Receive Curing Compound:

1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Maintain continuity of coating and repair damage during curing period.
4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer..

g. Floors To Receive Curing and Sealing Compound:

1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

h. Floors To Receive Densifier:
1) After concrete has cured for the minimum period recommended by the manufacturer, remove curing compound and surface contaminants by mechanical grinding sufficient to open pores and achieve a uniform, clean substrate (minimum CSP-2 to CSP-3).

3.17 APPLICATION OF LIQUID FLOOR DENSIFIER

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment in accordance with manufacturer's written instructions.
   1. Verify that surface has been mechanically prepared and is free of curing compound residue.
   2. Apply densifier by low-pressure sprayer followed by broom or microfiber applicator to ensure uniform saturation.
   3. Maintain surface in a uniformly wet condition for required reaction time per manufacturer instructions.

3.18 APPLICATION OF LIQUID TOPCOAT/SEALER

A. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller in accordance with manufacturer's written instructions.
   1. Mix Components A and B in accordance with manufacturer’s instructions.
   2. Apply using roller, or squeegee-and-backroll method, at manufacturer’s specified film thickness.
   3. Allow to cure for minimum period prior to light foot traffic and vehicular traffic per Sika’s published data.
   4. Apply second coat to increase chemical, abrasion, and stain resistance.

3.19 INSTALLATION OF JOINT FILLING

A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.

   1. Defer joint filling until concrete has aged at least one month.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.

D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.20 INSTALLATION OF CONCRETE SURFACE REPAIRS

A. Defective Concrete:

   1. Repair and patch defective areas when approved by Architect.

2. Remove and replace concrete that cannot be repaired and patched to meet specification requirements.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks in excess of 0.01 inch (0.25 mm) spalls, air bubbles exceeding surface finish limits, honeycombs, rock pockets, fins and other projections on the surface exceeding surface finish limits, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete.

    a. Limit cut depth to 3/4 inch (19 mm).
    b. Make edges of cuts perpendicular to concrete surface.
    c. Clean, dampen with water, brush-coat holes and voids with bonding agent.
    d. Fill and compact with patching mortar before bonding agent has dried.
    e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement, so that, when dry, patching mortar matches surrounding color.

    a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
    b. Compact mortar in place and match surrounding surface.

3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance, as determined by Architect.

D. Repairing Unformed Surfaces:

1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.

    a. Correct low and high areas.
    b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch (0.25 mm) wide

or that penetrate to reinforcement or completely through unreinforced sections regardless of width.

3. After concrete has cured at least 14 days, correct high areas by grinding.
4. Correct localized low areas during, or immediately after, completing surface-finishing operations by adding patching mortar.

    a. Finish repaired areas to blend into adjacent concrete.

5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.

    a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
    b. Feather edges to match adjacent floor elevations.

6. Correct other low areas scheduled to remain exposed with repair topping.

    a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations.
    b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

7. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete.

    a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around.
    b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
    c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
    d. Place, compact, and finish to blend with adjacent finished concrete.
    e. Cure in same manner as adjacent concrete.

8. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar.

    a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
    b. Dampen cleaned concrete surfaces and apply bonding agent.
    c. Place patching mortar before bonding agent has dried.
    d. Compact patching mortar and finish to match adjacent concrete.
    e. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.21 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.

B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency to be responsible for providing curing facility for initial curing of strength test specimens on-site and verifying that test specimens are cured in accordance with standard curing requirements in ASTM C31/C31M.
2. Testing agency to immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency to report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

C. Delivery Tickets: Comply with ASTM C94/C94M.

D. Inspections:

1. Steel reinforcement placement.
2. Headed bolts and studs.
3. Verification of use of required design mixture.
4. Concrete placement, including conveying and depositing.
5. Curing procedures and maintenance of curing temperature.
6. Verification of concrete strength before removal of shores and forms from beams and slabs.
7. Batch Plant Inspections: On a random basis, as determined by Architect.

E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M to be performed in accordance with the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 150 cu. yd. (114 cu. m) or fraction thereof.

a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing is to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M:

   a. One test at point of delivery for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   b. Perform additional tests as needed.

3. Slump Flow: ASTM C1611/C1611M:

   a. One test at point of delivery for each composite sample when strength test specimens are cast, but not less than one test for each day's pour of each concrete mixture.
   b. Perform additional tests as needed.

4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete;].

   a. One test for each composite sample when strength test specimens are cast, but not less than one test for each day's pour of each concrete mixture.

5. Concrete Temperature: ASTM C1064/C1064M:

   a. One test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample when strength test specimens are cast.

6. Concrete Density: ASTM C138/C138M:

   a. One test for each composite sample when strength test specimens are cast.

7. Compression Test Specimens: ASTM C31/C31M:

   a. Cast and standard cure two sets of **three** 6 inches (150 mm) by 12-inches (300 mm) cylindrical specimens for each composite sample.
   b. Cast and field cure two sets of three standard cylindrical specimens for each composite sample.

8. Compressive-Strength Tests: ASTM C39/C39M.

   a. Test one set of three standard cured specimens at seven days and one set of two specimens at 28 days.
   b. Test one set of two field-cured specimens at seven days and one set of two specimens at 28 days.

c. A compressive-strength test to be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor to evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests of standard cured cylinders equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa) if specified compressive strength is 5000 psi (34.5 MPa), or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi (34.5 MPa).
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests:

    a. Testing and inspecting agency to make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
    b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.

        1) Acceptance criteria for concrete strength to be in accordance with ACI 301 (ACI 301M), Section 1.7.6.3.

13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 (ASTM E1155M) within 48 hours of completion of floor finishing and promptly report test results to Architect.

3.22 PROTECTION

A. Protect concrete surfaces.

B. Protect from petroleum stains.

C. Prohibit vehicles from interior concrete slabs.

D. Prohibit placement of steel items on concrete surfaces.

END OF SECTION 03.3000

SECTION 03.3002 - CAST-IN-PLACE CONCRETE FOR UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies cast-in-place concrete, including reinforcement, concrete materials, mixture design, placement procedures, and finishes, for non-critical applications of concrete and for projects using small quantities of concrete.

1. Work involves cast in place concrete associated with utility installation including:

a. Base slabs.
b. Encasements.
c. Pipe encasements.
d. Thrust blocking.
e. Miscellaneous.
f. Other Work as indicated on the drawings.

B. Related Sections include the following:

1. Division 01 Section “Construction Waste Management” for additional information and procedures.
2. Division 31 Section "Excavation, Backfill and Compaction of Utilities".
3. Division 32 Section "Concrete Paving" for concrete pavement and walks.
4. Division 33 Section "Water Utility Distribution Piping".
5. Division 33 Section "Sanitary Utility Sewage Piping".
6. Division 33 Section "Storm Utility Drainage Utilities".

1.3 SUBMITTALS

A. General: In addition to the following, comply with submittal requirements in ACI 301.

B. LEED Submittals: For products having recycled content and/or regional materials content, submit recycled content and regional materials documentation for each such product provided under work of this Section in accordance with Section 018113.

C. Product Data: For each type of product indicated.

D. Design Mixtures: For each concrete mixture.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

B. Source Limitations: Obtain each type of cement of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

C. Comply with ACI 301, "Specification for Structural Concrete," including the following sections, unless modified by requirements in the Contract Documents:

1. "General Requirements."
2. "Formwork and Formwork Accessories."
3. "Reinforcement and Reinforcement Supports."
4. "Concrete Mixtures."
5. "Handling, Placing, and Constructing."
6. "Lightweight Concrete."

D. Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

PART 2 - PRODUCTS

2.1 FORMWORK

A. Furnish formwork and formwork accessories according to ACI 301.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Plain-Steel Wire: ASTM A 82, as drawn.

C. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

D. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout Project:

1. Portland Cement: ASTM C 150, Type I or II. Supplement with the following:

a. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

2. Blended Hydraulic Cement: ASTM C 595, Type IS, Portland blast-furnace slag cement.

B. Silica Fume: ASTM C 1240, amorphous silica.

C. Aggregate: ASTM C 33, uniformly graded, from a single source, with coarse aggregate as follows:

1. Class: 4S.
2. Maximum Aggregate Size: 1 inch nominal.
3. Do not use fine or coarse aggregates containing substances that cause spalling.

D. Water: ASTM C 94.

2.4 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain no more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures.

B. Air-Entraining Admixture: ASTM C 260.

C. Water-Reducing Admixture: ASTM C 494, Type A.

D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.

E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.

F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

2.5 CURING MATERIALS:

A. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

B. Water: Potable.

C. Clear Solvent-Borne Liquid-Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.6 RELATED MATERIALS:

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Bonding Agent: ASTM C 1059, Type II, and non-redispersible, acrylic emulsion or styrene butadiene.

2.7 CONCRETE MIXES

A. Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the trial batch method.

1. Do not use Owner's field quality-control testing agency as the independent testing agency.

C. Proportion mixes to provide concrete with the following properties in PennDOT Publication 408 Section 704 Table A Cement Concrete Criteria for the class and/or minimum mix design compressive strength indicated on the Drawings.

D. Cementitious Materials: Provide composite mix of Portland Cement and Ground Granulated Blast-Furnace Slag or Blended Hydraulic Cement and reduce percentage, by weight, of Portland Cement (ASTM C150) relative to total cementitious material weight for each design mix to at least 40 percent less than standard regional concrete mix designs.

Limit percentage, by weight, of standard Portland cement (C-150), to the following **maximum** percentages of the cementitious portion of the mix while maintaining the above 40% required reduction in Portland cement across the project's total quantity of concrete:

1. Exterior Concrete – 65 percent except as noted in paragraph E below.

E. Cementitious Materials for Exterior Concrete: For concrete exposed to deicers, limit percentage, by weight, of cementitious materials other than Portland cement according to ACI 301 requirements as follows:

1. Fly Ash: 25 percent.
2. Combined Fly Ash and Pozzolan: 25 percent.
3. Ground Granulated Blast-Furnace Slag: 50 percent.
4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent Portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
5. Silica Fume: 10 percent.
6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
7. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent Portland cement minimum, with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.

F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus or minus 1.5 percent:

1. Air Content: 6.0 percent in plastic state. Plastic concrete air content includes entrapped and entrained air.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, construct, erect, brace, and maintain formwork according to ACI 301.

3.2 STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

3.3 CONCRETE PLACEMENT

A. Comply with ACI 301 and PennDOT Publication 408 for measuring, batching, mixing, transporting, and placing concrete.

B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

C. Do not add water to concrete during delivery, at Project site, or during placement.

D. Consolidate concrete with mechanical vibrating equipment.

3.4 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 301 for hot-weather protection during curing.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this Article.

3.6 REPAIRS

A. Remove and replace concrete that does not comply with requirements in this Section as determined by Owner at no cost to Owner.

1. Defective concrete: Concrete not conforming to required lines, details, dimensions, tolerances, or specified requirements. Concrete with excessive honeycomb or embedded debris.

END OF SECTION 03.3002

SECTION 03.3533 - STAMPED CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Dry-shake colored hardener applied to exterior concrete paving surfaces as indicated on Drawings for interior and exterior concrete.
2. Stamping concrete patterns with special imprinting tools.
3. Curing of colored and imprinted concrete.

B. Related Sections:

1. Section 03.3000 “Cast-In-Place Concrete” for general concrete applications.
2. Section 07.9200 “Joint Sealants” for colored sealant installed in paving joints.
3. Section 08.1816 “Sliding Aluminum-Framed Glass Doors” for entry doors mounted on concrete paving.
4. Section 321313 “Concrete Paving” for basic concrete paving requirements.

1.2 REFERENCES

A. American Concrete Institute (ACI):

1. ACI 301: Specification for Structural Concrete for Buildings.
2. ACI 302.1R: Recommended Practice for Concrete Floor and Slab Construction.
3. ACI 303.1: Standard Specification for Cast-in-Place Architectural Concrete.
4. ACI 304: Recommended Practice for Measuring, Mixing, Transporting and Placing of Concrete.
5. ACI 305R: Recommended Practice for Hot Weather Concreting.
6. ACI 306R: Recommended Practice for Cold Weather Concreting.
7. ACI 308R, Guide to External Curing of Concrete.

B. ASTM International (ASTM):

1. ASTM C 260: Standard Specification for Air Entraining Admixtures for Concrete.
2. ASTM C 309: Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
3. ASTM C 979: Standard Specification for Pigments for Integrally Colored Concrete.

C. Portland Cement Association (PCA):

1. PA124: Finishing Concrete with Color and Texture.

1.3 SUBMITTALS

A. Product Data: For the following products:

1. Dry-shake colored hardener
2. Antiquing release agent
3. Liquid release agent
4. Imprinting/Texturing tools
5. Curing compound and sealer
6. Traction additive
7. Protection materials
8. Maintenance products.

B. Design Mixes: For each type of concrete.

C. Identify Application rates, substrate and ambient limits, drying times, and any placement restrictions.

D. Provide a Finish Schedule for each system to include the following:
1. Identify each area's base, accent colors and pigment dosage,
2. Hardener broadcast rate,
3. Stamp manufacturer and exact pattern designation,
4. Layout orientation,
5. Curing method,
6. Sealer and sheen.

E. System Confirmation:
1. Provide decorative-material manufacturer's confirmation of compatibility and sequence from placement through curing, release removal, final sealing, and maintenance.
    a. Address exterior air-entrained concrete and its effect on the stamping process, the preservation of surface freeze-thaw durability and retaining antiquing color under penetrating protection, and occasional wetting at interior openings.

F. Traction Evaluation Plan: Before mockup placement, submit a proposed wet and dry test method, equipment, applicable acceptance criteria, and third-party testing agency qualifications for Architect review. Select a method appropriate to the textured concrete and its anticipated wet pedestrian use. Do not apply smooth tile test criteria to stamped concrete without substantiation.

G. Shop Drawings:
1. Provide shop drawings showing placement sequence, pour boundaries, pattern direction, borders, actual slab joints, interfaces with walls and stairs, drains, floor

transitions, and folding-wall tracks and thresholds. Distinguish decorative impressions from structural and contraction joints.

2. Provide a Curing Plan which includes initial and continuing curing methods, duration, timing of release removal, protection during cleaning, and preparation for each sealer. Identify how curing residues will be removed without damaging color or texture.
   a. Do not rely on final penetrating sealer as a curing material.

H. Samples for Initial Selection: Manufacturer's color charts showing full range of available colors and pattern selections.

I. Physical concrete samples: Provide a minimum of four (4) - 12" x 12" physical samples of each system showing proposed base color, accent, texture, and final protection.

J. Qualification Data: For manufacturer and Installer.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 10 years of documented experience producing the specified products. Obtain all materials for the Project from a single manufacturer.

B. Installer Qualifications: Minimum 5 years of documented experience with work of three comparable completed installations, similar in scope and complexity required by this Project and acceptable to, or certified by, stamped concrete paving manufacturer.

C. Publications: Comply with applicable requirements of ACI 301 and PCA PA124.

D. Material Source: Obtain each specified material from the same source.

E. Close-out Materials: Provide placement records including concrete batch tickets, mix identification, measured concrete properties, weather, material lot numbers, treated areas, hardener quantities, curing dates, and sealer application records.

F. Notification: Give a minimum 7 calendar days' notice to manufacturer's authorized field representative before date established for commencement of work.

G. Stamped Concrete Paving Mockups:

1. Construct a minimum of three(3) separate interior and exterior field mockups, each mockup to be 10 foot by 10 foot at a location selected by Architect. Mockups to be large enough for at least two complete stamp repeats in both directions.

2. Include an actual sawcut contraction joint, isolation joint and sealant, representative edge, and a typical interface between interior and exterior. Demonstrate the folding-wall threshold transition in a separate full-scale assembly or within the mockup, include interior and exterior protection treatments.

3. Construct mockup using materials, processes, and techniques required for the work, including curing procedures. Incorporate representative control, construction, and expansion joints according to Project requirements. Installer for the work to construct mockup.
4. Demonstrate the complete proposed curing and release-removal sequence. On separate identified portions, compare proposed interior low-sheen protection with the natural penetrating treatment. Do not overlap incompatible treatments. Demonstrate the exterior antiquing appearance and adhesion after release removal and penetrating treatment.
5. The Design team shall evaluate color, variation, surface relief, recesses, joint alignment, cleanability, and sheen after curing and final protection have developed their representative appearance. Evaluations shall include inspecting finished paving under dry and wet conditions, under direct and grazing daylight and representative interior lighting.
6. Traction Testing: Perform wet and dry traction evaluations by an independent qualified agency using the approved plan. Contractor shall pay for initial tests and retests. Mockup approval shall address the final sealed surface, including proposed traction additive, rather than bare stamped concrete alone.
7. Notify Architect and Owner a minimum of seven calendar days in advance of the date scheduled for each mockup construction.
8. Obtain the Architect's and Owner's acceptance of each mockup prior to commencement of the work. Rebuild unacceptable mockups to the satisfaction of the Architect and the Owner.
9. Each mockup to remain until completion of the work to serve as a quality control standard for the work. Provide suitable protections to preclude damage to mockup.
10. Demolish and remove each mockup from site when directed.

H. Test reports and mockup approvals: Provide test reports of all materials and manufacturer's recommended procedures. Provide written acceptance of proposed corrective treatments before use.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in original factory unopened, undamaged packaging bearing identification of product, manufacturer, batch number, and expiration date as applicable.

B. Store products in a location protected from damage, construction activity, and adverse environmental conditions according to manufacturer's current recommendations.

1. Imprinting tools must be stored flat, textured face up, with no objects resting on top.

C. Handle products according to manufacturer's printed instructions.

1.6 PROJECT CONDITIONS

A. Schedule placement to minimize exposure to wind and hot sun before curing materials are applied.

B. Do not place concrete if rain, frost, or snow is forecast within 24 hours of placement. Protect fresh concrete from moisture and freezing conditions.

C. Compliance Standards: ACI 305R and ACI 306R.

D. Schedule concrete delivery to provide consistent mix times from batching until discharge. Mix times shall meet manufacturer's written recommendations.

1.7 PREINSTALLATION CONFERENCE

A. Preinstallation Mockup Conference: Prior to commencement of construction of the mockups, conduct a meeting with the Architect, Contractor, concrete supplier, finisher, decorative-material representative, testing agency, and folding-wall installer, and manufacturer's authorized field representative. Resolve scheduling, access, slab mixes, joints, thresholds, exterior drainage, weather protection, curing, cleaning, sealing, and construction protection.

B. Upon approval of the Mockups, and prior to scheduled date of concrete placement, conduct a meeting at Project site to discuss final installation requirements, and coordination efforts. Attendees to include Architect, Owner, Contractor, Installer, concrete supplier, and manufacturer's authorized field representative.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis of Design: Provide products specified herein manufactured by Sika Corporation.

B. Systems:
1. System P1 Interior Promenade: Dry-shake color hardener, shallow rectangular stone stamp, restrained antiquing, coordinated curing, and clear low-sheen film-forming protection suitable for intermittent wet pedestrian service. Do not provide a polished or high-gloss finish.
2. System P2 Exterior Pedestrian Paving: Dry-shake color hardener, rectangular stone stamp with slip-resistant texture, restrained antiquing where compatible, coordinated curing, and clear non-film-forming silane/siloxane protection. Natural appearance; no wet-look film unless subsequently authorized by Architect.

2.2 MATERIALS

A. Dry-Shake Colored Hardener: Cementitious material containing special hard aggregates, formulated as a high opacity color hardening material for the top surface of freshly place concrete substrates. Highly UV-resistant. Factory proportioned, mixed and packaged, ready-to-use. Comply with ASTM C 979.

1. Product: “LITHOCHROME Color Hardener”, Sika Corporation.
2. Colors: A maximum of four (4) colors blended as selected from manufacturer’s full range of colors.

B. Imprinting Tools: System of matched tools for imparting textures and patterns into freshly placed concrete surfaces.
1. Product: “LITHOTEX Pavecrafters”, Sika Corporation.
2. Patterns: Rectangular Ashlar Stone. Architect shall select exact pattern and scale from physical samples.
    a. Interior: Provide shallow, gently textured relief with narrow, restrained impressions and no sharp ridges.
    b. Exterior: Provide a more pronounced relief where approved for drainage, traction, and accessibility. Relief and recess dimensions shall be established on approved shop drawings and mockups.

C. Antiquing Release Agent: Colored, finely powdered material formulated to break the bond between imprinting tools and surface of color-hardened concrete while imparting an antiqued appearance.

1. Product: “LITHOCHROME Antiquing Release Pro”, Sika Corporation.
2. Colors: Architect-selected contrasting color from manufacturer’s full range of colors.

D. Liquid Release Agent: Colorless, scented liquid formulated to break the bond between imprinting tools and surface of color-hardened concrete. Evaporates completely, leaving no residue.

1. Product: “SCOFIELD Liquid Release BG”, Sika Corporation.

E. Interior Protective Sealer:
1. Waterborne Curing Compound and Sealer: Low VOC waterborne modified acrylic formulation. Complies with ASTM C 309. Subject to approval of actual sheen, traction, and complete assembly:
    a. Product: “SCOFIELD Cureseal-W”, Sika Corporation.
    b. Low-Sheen.

F. Exterior Protective Sealer:
1. Solvent-Borne Curing Compound and Sealer: Complies with ASTM C 309.

2. Product: SikaCem-102 First Seal, Sika Corporation

G. Traction Additive: Manufacturer-approved transparent additive compatible with the interior film-forming sealer where required to achieve approved traction. Dosage and application shall match the accepted mockup. Do not broadcast arbitrary sand onto finished paving or add traction particles to penetrating sealer.

H. Temporary Protection: Nonstaining, manufacturer-approved protection that does not interfere with curing, trap moisture unevenly, or imprint the surface. Provide load-distribution boards beneath equipment. Do not tape directly to finished concrete.

I. Joint Sealants and Fillers: As specified in related Sections; traffic-compatible, nonstaining materials coordinated with joint movement, wet exposure, sealer adhesion. Colors to be selected from manufacturer's full color range.

2.3 CONCRETE MIX DESIGN

A. General: Refer to Section 32.1313 "Portland Cement Concrete Paving" for basic concrete paving requirements, including formwork, reinforcement, concrete materials, and mixing.

B. Minimum Cement Content: 5-1/2 sacks per cubic yard of concrete.

C. Mix design must not permit segregation of concrete materials during pumping, placing, or consolidation of concrete. Slump not to exceed 4 inches.

D. Admixtures:

1. A normal or retarded-set, water-reducing admixture is permissible.
2. An air-entraining admixture complying with ASTM C 260 is acceptable where freeze/thaw durability is required.
3. A non-chloride accelerator is acceptable for cold weather concrete placement.
4. Do not add a high-range water reducing admixture (superplasticizer).

E. Calcium Chloride accelerators are NOT acceptable and shall not be added to the concrete mix.

F. Use of fly ash as a cement replacement may be acceptable, subject to manufacturer's current recommendations.

G. Do not add water to the mix in the field.

PART 3 - EXECUTION

3.1 SUBGRADE PREPARATION

A. Subgrade to receive stamped concrete paving work must be well drained and have adequate, uniform loadbearing characteristics.

1. Verify grading will ensure a uniform concrete thickness during concrete placement.

B. Interior slabs: Verify slab support, vapor retarder, reinforcement, forms, drainage, penetrations, and joint locations before placement. Report conditions preventing specified finish. Begin installation when all unsatisfactory conditions have been corrected..

C. Set elevations at folding-wall tracks, thresholds, stairs, adjacent floors, and exterior paving to the approved details. Protect door track drainage and weep paths. Do not bridge required movement joints. Slope exterior slabs away from Sliding Aluminum-Framed Glass Entry Doors.

D. Lay out the stamp grid and actual slab joint plan together according to approve shop drawings. Locate cuts within decorative lines where feasible without compromising required slab panel geometry or joint function. Obtain approval of unavoidable cuts through the decorative pattern before placing concrete.

E. At the time of concrete placement, subgrade must be moist, completely consolidated, and free from frost. If necessary, subgrade may be dampened with water prior to placement; however, freestanding water or soft, muddy, or frozen ground in not permissible.

3.2 CONCRETE PLACEMENT

A. General: Place and spread concrete to completely fill all space inside forms. Move concrete into place with square-tipped shovels or concrete rakes.

B. Consolidate concrete by tamping or vibrating to provide a suitable surface for finishing.

C. Prior to appearance of excess moisture or bleed water, screed concrete with wood or magnesium straight edge or mechanical vibrating screed.

D. Continue concrete surface leveling and consolidation with highway magnesium straight edge and (or) magnesium bull float.

E. Mechanically float concrete surfaces to required flatness and levelness as soon as concrete surface has taken its initial set and will support weight of a power float machine equipped with float shoes or combination blades and operator.

1. Comply with ACI 302.1R for acceptable tolerances.

F. Completed concrete placement to result in an open surface suitable to receive colored hardener.

3.3 STAMPED CONCRETE PAVING INSTALLATION

A. Apply 2/3 of dry-shake colored hardener at specified application rate to freshly floated concrete surface. Bleed water must not be present during or following application of first and second dry-shake applications.

B. Do not throw dry-shake colored hardener material; distribute evenly using mechanical spreader designed to apply floor hardeners. Mechanical spreader manufacturer as acceptable to stamped concrete paving manufacturer.

C. As soon as dry-shake material has absorbed moisture, indicated by uniform darkening of surface, mechanically float concrete surface a second time, just enough to bring moisture from base slab through dry-shake color hardener.

D. Immediately following second floating, apply remaining 1/3 of dry-shake colored hardener at specified application rate. If applied by hand, broadcast in opposite direction of first application for a more uniform coverage. If a mechanical spreader is used, apply in same manner as previously described.

E. As soon as dry-shake material has absorbed moisture, mechanically float concrete surface a third time.

F. Do not add water to the surface.

G. Record containers used and area treated for each placement. Submit all placement records at Project Closeout.

H. Keep exterior finishing compatible with required entrained air and freezing exposure. Do not burnish exterior concrete or use aggressive hard troweling to obtain a smooth, closed surface. Use only the exterior stamping and finishing procedure confirmed in the approved manufacturer submittal and mockups.

3.4 STAMPING AND ANTIQUING

A. Apply approved release uniformly and stamp at the proper concrete consistency. Use sufficient matching and companion tools to avoid repetitive obvious defects, incomplete impressions, or over-deep depressions. Maintain alignment, pattern scale, borders, and approved texture.

B. Tool edges and difficult locations to match adjacent work. Remove raised fins and sharp edges without exposing gray concrete or erasing the texture. Do not create recesses that retain objectionable water or interfere with normal wheeled pedestrian use.

C. Control antiquing to the approved restrained variation. Do not obscure base color with a heavy dark surface layer. Remove loose release and contaminants by manufacturer-approved methods at the approved time, preserving only firmly retained secondary color compatible with the sealer.

D. Do not use aggressive acid washing or abrasive blasting to correct color or remove residue without an approved trial. Where the required exterior cleanliness removes the intended antiquing, use the approved alternative coloring sequence rather than sealing over residue.

3.5 JOINTS

A. Construct contraction, construction, and isolation joints to the approved layout. Decorative stamp lines alone do not constitute contraction joints. Keep isolation and movement joints free to function through all finishes.

B. Saw joints as soon as concrete permits cutting without unacceptable raveling and before uncontrolled shrinkage cracking develops. Protect edges, remove slurry promptly, and prevent staining. Required depth and spacing shall follow the approved slab design.

C. Prepare and seal or fill joints where indicated after the required curing and drying. Coordinate sealant sequencing with sealer instructions; keep sealers off joint bond surfaces unless compatibility is established.

3.6 CURING

A. Begin curing as soon as surface conditions permit, using the approved sequence. Maintain effective curing for at least seven days unless a different duration is required by the concrete specification or approved for the mix and curing method. Protect from uneven drying, freezing, rain damage, and staining.

B. Coordinate early protection, release removal, cleaning, and continuing curing so concrete does not remain unprotected while waiting for cleaning or final sealer. Do not delay curing until concrete is old enough to wash. If the proposed sequence cannot provide effective curing, revise it before placement.

C. Use only demonstrated nonstaining covers or curing materials. Prevent wrinkles, differential moisture, and runoff from producing unacceptable mottling. Remove temporary curing residues as required before final protection.

D. Interior curing and final sealing may use a compatible cure-and-seal sequence where approved. Exterior membrane curing requires complete removal or verified dissipation before penetrating protection, without damage to the decorative surface. Do not assume weathering alone establishes readiness.

3.7 SEALING

A. Prior to sealing, the following conditions must be present:

1. Release agent has been removed.
2. Moisture content of concrete is low enough that alkali and other salts do not become trapped beneath sealer. This will require a minimum of 28 days subsequent to concrete placement, or longer if required.
3. No evidence of free water on concrete surfaces to receive curing and sealing compound.

B. Interior: Apply the approved film-forming system in uniform thin coats at approved coverage. Prevent puddles, lap marks, whitening, roller tracks, and excessive gloss. Incorporate approved traction additive consistently. More coats shall not be used as a substitute for correct application.

C. Exterior: Apply penetrating sealer only to clean, dry, absorbent concrete free of obstructing release, curing, and sealing residues. Conduct a trial to verify absorption and appearance. Prevent ponding and overspray; use the current product application procedure. Do not apply a decorative film coat over the penetrating treatment unless separately approved.

D. Apply two coats of specified curing and sealing compound according to manufacturer's written instructions.

E. At folding-wall transitions, stop each treatment at the approved defined boundary. Maintain required track clearances and drainage. Match the approved mockup's coordinated appearance; do not field-adjust color by adding pigment to clear protection.

F. Protect treated surfaces for the full manufacturer-required drying and service period. Do not open folding walls, wet the surface, or allow traffic earlier than the approved application conditions permit.

3.8 FIELD QUALITY CONTROL AND ACCEPTANCE

A. Architect shall inspect completed work against the approved mockups after curing and final protection. Only work with consistent intended variation, complete pattern impressions, sound surfaces, functional joints, approved sheen, and drainage conforming to Drawings shall be accepted.

B. Contractor shall employ the use of an independent third-party agency to verify final wet and dry traction at each distinct finish/protection system and at representative folding-wall transitions using the approved method and criteria. Correct all deficiencies and retest before acceptance.

C. The following conditions shall be causes for rejection of installed patterned concrete:
1. Delaminated or dusting surfaces,

2. Exposed gray areas from deficient coverage,
3. Objectionable ridges or depressions,
4. Sealer whitening or peeling,
5. Variations of color or texture exceeding the approved mockups.

D. Deficiencies and cracks shall be evaluated with Architect and structural designer for cause and required repair; do not conceal cracks with tinted sealer.

E. Submit repair methods and demonstrate repairs in a trial area. Repair only where appearance and performance are acceptable to Architect. Otherwise remove and replace the affected panel between approved joints. Do not patch broad defective areas with a thin decorative overlay without authorization.

3.9 PROTECTION OF FINISHED WORK

A. Prohibit foot or vehicular traffic on the newly imprinted concrete surface.

B. Protect floor surface from damage throughout remainder of construction period until Final Acceptance of the work. If a covering material is necessary, surfaces must remain uncovered for a minimum of four days after which they may be covered with a new, smooth, nonstaining reinforced kraft curing paper. Plastic sheeting is unacceptable as a covering material.

C. Clean with approved equipment and neutral or mild manufacturer-approved cleaner. Remove grit before wet cleaning. Do not use acid, solvent, aggressive abrasive pads, or high-pressure cleaning that damages color, texture, joints, or sealer.

D. Before turnover, remove temporary protection, clean all surfaces, and restore approved uniform appearance. Renew damaged protection only using an approved method; do not apply an indiscriminate extra coat over the entire installation.

3.10 MAINTENANCE AND OWNER INSTRUCTION

A. Provide written maintenance instructions separately for P1 and P2. Identify approved cleaners, dilution, pads or brushes, cleaning equipment, spill response, inspection frequency, reapplication triggers, surface preparation, and compatible repair materials. Do not describe the system as maintenance-free.

B. Interior: Remove tracked grit routinely; damp clean as conditions require and remove spills promptly. Inspect high-traffic paths and entrances for film wear, loss of traction, whitening, or adhesion failure. Clean and renew worn protection before the colored surface is damaged. Do not wax, burnish, or add aftermarket floor dressing unless specifically approved and demonstrated for wet traction.

C. Exterior: Sweep and wash with approved mild cleaner. Inspect water repellency after cleaning and drying; renew penetrating treatment when absorption indicates loss of protection, following

manufacturer instructions. Do not coat over contamination or assume a fixed renewal interval applies to all exposure conditions.

D. Winter Care: Provide manufacturer-approved snow-removal tools and deicer restrictions for the concrete and decorative system, including first-winter limitations. Avoid metal-edge scraping and aggressive ice chopping. Do not stockpile deicers on the surface. Remove tracked salts from the promenade promptly.

E. Demonstrate cleaning and local protection renewal to Owner's maintenance personnel. Deliver a repair and renewal record form. Retain product identifiers, color formulas, approved mockup photographs, and actual installation records with the maintenance manual. Unused materials may be retained only within shelf life and approved storage conditions.

END OF SECTION 03.3533

SECTION 04.2000 –UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Face brick.
3. Mortar and grout.
4. Steel reinforcing bars.
5. Masonry joint reinforcement.
6. Ties and anchors.
7. Embedded flashing.
8. Miscellaneous masonry accessories.
9. Cavity-wall insulation.

B. Related Sections:

1. Section 04.3313.13 "Anchored Stone Masonry Veneer" for installing and anchoring sections of stone masonry veneer to structural backup materials..
2. Section 05.1200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
3. Section 05.5000 "Metal Fabrications" for furnishing steel lintels and shelf angles for unit masonry.
4. Section 07.6200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

C. Exposed: Weather-exposed side of a constructed wall.

1.4 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in TMS 602.
2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

1.5 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

1. Clay Masonry Unit Test: For each type of unit required, according to ASTM C 67 for compressive strength.
2. Concrete Masonry Unit Test: For each type of unit required, according to ASTM C 140 for compressive strength.
3. Mortar Test (Property Specification): For each mix required, according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
4. Mortar Test (Property Specification): For each mix required, according to ASTM C 780 for compressive strength.
5. Grout Test (Compressive Strength): For each mix required, according to ASTM C 1019.
6. Prism Test: For each type of construction required, according to ASTM C 1314.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection:

1. Face brick, in the form of straps of five or more bricks.
2. Colored mortar.
3. Weep holes/vents.

D. Samples for Verification: For each type and color of the following:

1. Exposed CMUs.
2. Face brick, in the form of straps of five or more bricks.
3. Special brick shapes.
4. Pigmented and colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project.
5. Weep holes and vents.
6. Accessories embedded in masonry.

1.7 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Qualification Data: For testing agency.

C. Material Certificates: For each type and size of the following:

1. Masonry units.

a. Include material test reports substantiating compliance with requirements.
b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
c. For exposed brick, include test report for efflorescence according to ASTM C 67.
d. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.

2. Integral water repellent used in CMUs, if not surface treated.
3. Cementitious materials. Include brand, type, and name of manufacturer.
4. Mortar Admixtures.
5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
6. Grout mixes. Include description of type and proportions of ingredients.

7. Reinforcing bars.
8. Joint reinforcement.
9. Anchors, ties, and metal accessories.

D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in TMS 602.

F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

B. Project team craftworkers of the Masonry Contractor assigned to Project will be required to have the International Masonry Institute - Flashing Training or equal and to provide evidence of certificate or a letter of the firm's commitment to enroll key project personnel in the training program prior to the start of Project.

C. Project team craftworkers of the Masonry Contractor assigned to Project will be required to have the International Masonry Institute - Grouting and Reinforcing Training or equal and to provide evidence of certificate or a letter of the firm's commitment to enroll key project personnel in the training program prior to the start of Project.

D. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

E. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

F. Masonry Standard: Comply with TMS 602 unless modified by requirements in the Contract Documents.

G. Mockups: Mockups: Construct a combined exterior wall mockup to verify selections made under Sample submittals, demonstrate aesthetic effects, and establish quality standards for materials and execution. Coordinate with Section 04.4200 “Exterior Stone Cladding” and the applicable metal wall panel Section. One combined mockup shall satisfy the overlapping requirements of these Sections.
   1. Construct mockup with an exposed face not less than 8 feet long by 6 feet high, full wall thickness, and a corner return not less than 2 feet long. Locate mockup where approved by Architect. Enlarge mockup as necessary to demonstrate the following:
      a. Each type of exposed masonry construction, including brick and full-bed stone veneer, with representative unit sizes, color blending, stone arrangement, mortar colors, joint widths, and joint tooling.
      b. Brick-to-stone transition, including attachment, flashing, and movement-joint conditions indicated on Drawings.
      c. Metal wall panel construction occupying approximately the upper one-third of the mockup. Include the indicated transition between masonry and metal wall panels, including supporting construction, closures, flashing, and continuity of insulation and air and water-resistive barrier.
      d. Representative window opening with frame, limestone sill, head and jamb conditions, stone returns where indicated, perimeter sealants, flashing, and end dams. Size opening sufficiently to demonstrate actual construction details.
      e. Representative backup construction, including metal studs and sheathing or unit masonry as applicable, air and water-resistive barrier, insulation, veneer anchors and ties, drainage cavity, through-wall flashing, cavity drainage material, and weep/vents.
      f. Sealant-filled movement joint not less than 16 inches long and representative shelf-angle support condition, including compressible joint, where occurring in the Work.
      g. Leave representative portions of concealed construction exposed for review, including not less than 12 inches of through-wall flashing. Obtain Architect’s review of concealed components before covering.
   2. Clean exposed masonry faces using materials and methods specified for each masonry type. Demonstrate cleaning procedures on the mockup before using them on completed Work. Protect stone and adjacent materials from incompatible cleaners.
   3. Obtain Architect’s approval before proceeding with corresponding Work. Approval establishes the standard for color, texture, blending, stone arrangement, mortar and sealant colors, joint widths and tooling, transitions, and workmanship. Approval also applies to other materials and construction qualities specifically approved by Architect in writing.
   4. Approval of mockup does not constitute approval of deviations from Contract Documents unless specifically approved by Architect in writing.

5. Maintain approved mockup undisturbed and protect it from damage and deterioration until completion of corresponding Work. Keep exposed faces available for comparison with completed construction.

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01.3100 "Project Management and Coordination."

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install them until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.10 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
2. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Masonry Standard: Comply with TMS 402/602 except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

C. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

2. Provide bullnose units for outside corners unless otherwise indicated.

B. Pattern: Refer to Drawings for stacking pattern.

C. CMUs: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi.
2. Density Classification: Normal weight unless otherwise indicated.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

2.3 CONCRETE AND MASONRY LINTELS

A. General: Provide one of the following as indicated in lintel schedule.

B. Concrete Lintels: ASTM C 1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength not less than CMUs.

C. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.4 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Face Brick: Facing brick complying with ASTM C 216 (BASIS OF DESIGN).
1. Products:
   a. Brick Type BR-1: Belden Brick, Extruded, Smooth, Ambasador, FBX, Cored, “#470-479 Dark Ironspot”.

b. Brick Type BR-2: Belden Brick, #470-479 Dark, Smooth, Ambassador, FBX, Solid, “Napier Blend Velour”.

2. Grade: SW.
3. Type: FBX.
4. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3,350 psi.
5. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested per ASTM C 67.
6. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
7. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 15-5/8 inches long.
8. Application: Use where brick is exposed unless otherwise indicated.

2.5 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of Portland cement complying with ASTM C 150, Type I or III, and hydrated lime containing no other ingredients, complying with ASTM C 207, Type S.

D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Davis Colors; True Tone Mortar Colors.
b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
c. Solomon Colors, Inc.; SGS Mortar Colors.

E. Colored Cement Product: Packaged blend made from Portland cement and lime mix or mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Colored Masonry Cement:

a. Products: Subject to compliance with requirements, provide one of the following:

1) Capital Materials Corporation; Flamingo Color Masonry Cement.
2) Essroc, Italcementi Group; Brixment-in-Color.
3) Holcim (US) Inc.; Rainbow Mortamix Custom Color Masonry Cement.
4) Lafarge North America Inc.; U.S. Cement Custom Color Masonry Cement.
5) Lehigh Cement Company; Lehigh Custom Color Masonry Cement.
6) National Cement Company, Inc.; Coosa Masonry Cement.

2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
3. Pigments shall not exceed 10 percent of Portland cement by weight.

F. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

G. Aggregate for Grout: ASTM C 404.

H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Euclid Chemical Company (The); Accelguard 80.
b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.

I. Water: Potable.

2.6 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.

1. Interior Walls: Mill- galvanized, carbon steel.
2. Exterior Walls: Hot-dip galvanized, carbon steel.
3. Wire Size for Side Rods: 0.148-inch diameter.
4. Wire Size for Cross Rods: 0.148-inch.

5. Wire Size for Veneer Ties: 0.187-inch diameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

D. Masonry Joint Reinforcement for Multi-wythe Masonry:
1. Adjustable(two piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum horizontal play of 1/16 inch (1.5mm) and maximum vertical adjustment of 1-1/4 inches . Size ties to extend at least halfway through facing wythe but at least 5/8-inc cover on outside face,
2. Basis of Design Product: Subject to compliance with requirements, provide Hohmann & Barnard Inc Model #270-2X Ladder-eye Lox-All adjustable Joint Reinforcement with 2X Hook, or Equal as approved by Architect in Writing before bid.
    a. Where Discrepancies occur between the information contained in contract drawings and specification, submit discrepancies to the Architect in writing before the Bid.

2.7 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.

B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.

C. Brick Veneer Anchor for Stud Back Up – Adjustable
1. Basis of Design Product: Subject to compliance with requirements, provide Hohmann & Barnard, Inc. Model HB-213-2X Adjustable Veneer Anchor with 2X HOOK, or equal as approved by the Architect in writing before the Bid.
    a. Where discrepancies occur between the information contained in the Contract Documents and the Specification, submit discrepancies to the Architect in writing for clarification before the Bid.
2. Backplate: 14 ga.
3. Pintle: Length as desired.
4. Finish: Hot-Dipped Galvanized.

D. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.

1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units.
2. Where wythes do not align, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.
3. Wire: Fabricate from 3/16-inch- diameter, hot-dip galvanized steel wire.

E. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.25-inch- diameter, hot-dip galvanized steel wire.

F. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.25-inch- diameter, hot-dip galvanized steel wire.

G. Partition Top anchors: 0.105-inch- thick metal plate with 3/8-inch- diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

H. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.

1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

2.8 MISCELLANEOUS ANCHORS

A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.

B. Dovetail Slots in Concrete: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.034-inch, galvanized steel sheet.

C. Anchor Bolts: Headed steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

D. Post-installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Load Capacity: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when

installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 unless otherwise indicated.
3. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.9 EMBEDDED THRU WALL FLASHING MATERIALS

A. Flexible Flashing: Use the following unless otherwise indicated:

1. Product standard of quality:
   a. York Manufacturing, Inc.; Multi-Flash SS
   b. Illinois Products, Inc.; IPCO Stainless Steel Fabric Flashing
   c. Prosoco, Inc.; R-Guard SS ThruWall
   d. STS Coatings, Inc.; Wall Guardian Stainless Steel TWF
   e. TK Products, Inc.; TK TWF

B. Characteristics:

1. Type: Stainless steel core with polymer fabric laminated to the bottom stainless steel face with non-asphalt adhesive. The top face (exposed side) must not be covered with a polymer fabric.
2. Stainless steel: type 304, ASTM A240. Domestically sourced per DFARS 252.225-7008 and/or DFARS 252.225-7009.
3. Fabric: polymer fabric; laminated back face (non-exposed side) of stainless steel core.
4. Size: Manufacturer's standard width rolls.

C. Accessories:

1. Mastic/sealant: Product standard of quality is York Manufacturing, Inc.; UniverSeal US100.
   a. Characteristics:
      1) Type: One part 100% solids, solvent-free formulated silyl-terminated polyether (STPE), ASTM C920-11, Type S, Grade NS, Class 50.
2. Outside corner and inside corner material; manufacturer’s standard available units using:
   a. Stainless steel: 26 gauge stainless steel.
3. End dam: Product may be folded in line with the flashing material or utilize preformed end dams by manufacturer using:
   a. Stainless steel: 26 gauge stainless steel.
4. Splice material: Product standard of quality is York304 SS by York. Manufacturer’s standard self-adhered metal material; material matching system material or use Multi-Flash Stainless Steel 6” lap piece and polyether sealant as a splice.

5. Termination bar: Product standard of quality is York T-96 termination bar. Manufacturer's standard 1" composite material bar or a 1" 26 gauge stainless steel termination bar with sealant lip.
6. Weep vent protection: Product standard of quality is York's Weep Armor. Geotextile drainage fabric at least 12" in height.
7. Repair and other materials/accessories: Manufacturer's standard.
8. Fasteners: Domestic manufactured fastener types and sizes recommended by flashing manufacturer for intended use.

D. Application: Unless otherwise indicated, use the following:

1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge.
4. Where flashing is fully concealed, use flexible flashing.

E. Single-Wythe CMU Flashing System: System of CMU cell flashing pans and interlocking CMU web covers made from high-density polyethylene incorporating chemical stabilizers that prevent UV degradation. Cell flashing pans have integral weep spouts that are designed to be built into mortar bed joints and weep collected moisture to the exterior of CMU walls and that extend into the cell to prevent clogging with mortar.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Mortar Net USA, Ltd.; Blok-Flash.
b. Approved equal.

F. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.10 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Compressible 3/8-inch thick closed cell neoprene material conforming to ASTM D1056 Grade 2A1, "NS – Closed Cell Neoprene Sponge" as manufactured by Hohmann & Barnard, Inc.; or approved equal approved by Architect.

B. Preformed Control-Joint Gaskets: Factory-manufactured styrene-butadiene rubber (SBR) control-joint gaskets complying with ASTM D2000, Designation M2AA-805, designed to fit standard sash block and maintain lateral stability of the masonry wall.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Hohmann & Barnard, Inc.; RS Series Rubber Control Joint (RS-STD, RS-TEE, RS-8, or RS-12 as required).
b. Wire-Bond.
c. Approved equal.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt). Use as indicated on the Drawings.

D. Weep/Vent Products: Use the following unless otherwise indicated:

1. Mesh Weep/Vent: "CavClear" non-woven recycled polymer mesh flame-retardant binder and "M" notched bottom as manufactured by Archovations, Inc., Hudson, WI, or equal product of other manufacturer approved in advance by Architect. Color as selected from the full range of manufacturer's colors.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Mortar Trap by Hohmann Barnard.
   b. Mortar Net USA, Ltd.; Mortar Net.

2. Provide one of the following configurations:

   a. Strips, full-depth of cavity and 10 inches high, with dovetail shaped notches 7 inches deep that prevent clogging with mortar droppings.

F. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
   b. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
   c. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

G. Premolded Joint Fillers: Closed-cell neoprene or EPDM joint filler complying with ASTM D1056, Grade 2A1, sized as indicated for bond beam control joints.

2.11 CAVITY-WALL INSULATION

A. Sprayed in place ASTM E 84 Class I fire-rated polyurethane foam insulation, 2.4 pcf normal density per ASTM D 1622, aged thermal resistance at 2-inches R-14 per ASTM C 518, air permeance less than 0.02 L/s.m^2 at 1-inch per ASTM E 2178, air barrier assembly at 1-inch

complies with ASTM E 2357, water vapor permeance at 0.97 perm at 1.5-inches per ASTM E 96. Basis of design spray foam insulation shall be “ProSeal LE” as manufactured by Icynene Inc., or equal product of other manufacturer approved by the Architect.

B. Transition Membranes – Self-Adhered:
   1. Blueskin SA by Henry Company
   2. AirShield by W.R. Meadows

C. Source Quality Control
   1. Insulation product components produced in an ISO 9001 registered factory.

2.12 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following

      a. Diedrich Technologies, Inc.
      b. EaCo Chem, Inc.
      c. Prosoco, Inc.

2.13 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

   1. Do not use calcium chloride in mortar or grout.
   2. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

   1. For masonry below grade or in contact with earth, use Type S.

2. For reinforced masonry, use Type S.
3. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
4. For interior non-load-bearing partitions, Type O may be used instead of Type N.

D. Pigmented Mortar: Use colored cement product**.** Do not add pigments to colored cement products.

1. Pigments shall not exceed 10 percent of Portland cement by weight.
2. Mix to match Architect's sample.
3. Application: Use pigmented mortar for exposed mortar joints with the following units:
   a. Face brick.
   b. Limestone trim units.

E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

1. Mix to match Architect's sample.
2. Application: Use colored aggregate mortar for exposed mortar joints with the following units:
   a. Face brick.
   b. Limestone trim units.
   c. Stone veneer units.

F. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in TMS 402 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 3000 psi.
3. Provide grout with a slump of 10 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed.

F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.

3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in bond pattern indicated on Drawings; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078446 "Fire-Resistive Joint Systems."

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow brick and CMUs as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Lay structural-clay tile as follows:

1. Lay vertical-cell units with full head joints unless otherwise indicated. Provide bed joints with full mortar coverage on face shells and webs.
2. Lay horizontal-cell units with full bed joints unless otherwise indicated. Keep drainage channels, if any, free of mortar. Form head joints with sufficient mortar so excess will be squeezed out as units are placed in position. Butter both sides of units to be placed, or butter one side of unit already in place and one side of unit to be placed.
3. Maintain joint thicknesses indicated except for minor variations required to maintain bond alignment. If not indicated, lay walls with 1/4- to 3/8-inch- thick joints.
4. Where epoxy-mortar pointed joints are indicated, rake out setting mortar to a uniform depth of 1/4 inch and point with epoxy mortar to comply with epoxy-mortar manufacturer's written instructions.

D. Set limestone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.

1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
2. Allow cleaned surfaces to dry before setting.
3. Wet joint surfaces thoroughly before applying mortar.

E. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

F. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.6 COMPOSITE MASONRY

A. Bond wythes of composite masonry together using one of the following methods:

1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 2.67 sq. ft. of wall area spaced not to exceed 24 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.

    a. Where bed joints of wythes do not align, use adjustable (two-piece) type ties.

2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.

    a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
    b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.

3. Header Bonding: Provide masonry unit headers extending not less than 3 inches into each wythe. Space headers not over 8 inches clear horizontally and 16 inches clear vertically.

B. Bond wythes of composite masonry together using bonding system indicated on Drawings.

C. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.

D. Corners: Provide interlocking masonry unit bond in each wythe and course at corners unless otherwise indicated.

1. Provide continuity with masonry joint reinforcement at corners by using prefabricated L-shaped units as well as masonry bonding.

E. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:

1. Provide individual metal ties not more than 16 inches o.c.
2. Provide continuity with masonry joint reinforcement by using prefabricated T-shaped units.
3. Provide rigid metal anchors not more than 24 inches o.c. If used with hollow masonry units, embed ends in mortar-filled cores.

3.7 CAVITY WALLS

A. Bond wythes of cavity walls together using one of the following methods:

1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 2.67 sq. ft. of wall area spaced not to exceed 24 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.

    a. Where bed joints of wythes do not align, use adjustable (two-piece) type ties.
    b. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type ties to allow for differential movement regardless of whether bed joints align.

2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.

    a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
    b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties].
    c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.

3. Header Bonding: Provide masonry unit headers extending not less than 3 inches into each wythe. Space headers not over 8 inches clear horizontally and 16 inches clear vertically.
4. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.

B. Bond wythes of cavity walls together using bonding system indicated on Drawings.

C. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

D. Parge cavity face of backup wythe in a single coat approximately 3/8 inch thick. Trowel face of parge coat smooth.

E. Coat cavity face of backup wythe to comply with Section 07.1113 "Bituminous Dampproofing."

F. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.

1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.8 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.
2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.9 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:

1. Provide an open space not less than 1 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.10 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to concrete and masonry backup with seismic masonry-veneer anchors to comply with the following requirements:
1. Embed connector sections and continuous wire in masonry joints. Provide not less than 2 inches of air space between back of masonry veneer and face of sheathing.
2. Locate anchor sections to allow maximum vertical differential movement of ties up and down.

3. Space anchors as indicated, but not more than 18 inches o.c. vertically and 24 inches o.c. horizontally, with not less than 1 anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around perimeter.
4. Space anchors as indicated, but not more than 16 inches o.c. vertically and 24 inches o.c. horizontally with not less than 1 anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.

3.11 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
   1. Form control joints in concrete masonry using the preformed control-joint gasket specified in Part 2. Install in accordance with the manufacturer's written instructions.

B. Form expansion joints in brick as follows:

   1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
   2. Build flanges of factory-fabricated, expansion-joint units into masonry.
   3. Build in compressible joint fillers where indicated.
   4. Form open joint full depth of brick wythe and of width indicated, but not less than 1/2 inch for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."

C. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 07.9200 "Joint Sealants," but not less than 3/8 inch >.

   1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.12 LINTELS

A. Install steel lintels where indicated.

B. Provide concrete lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.13 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to provide upward air flow in cavities, and where indicated.

B. Install flashing as per Drawings.

C. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:

1. Use specified weep/vent products to form weep holes.
2. Space weep holes 24 inches o.c. unless otherwise indicated.

3.14 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 402.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 402 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches

3.15 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Level 1 special inspections according to the "International Building Code."

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

E. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.

F. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

G. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

H. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.

I. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

J. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.

3.16 PARGING

A. Parge exterior faces of below-grade masonry walls, where indicated, in 2 uniform coats to a total thickness of 3/4 inch. Dampen wall before applying first coat and scarify first coat to ensure full bond to subsequent coat.

B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot. Form a wash at top of parging and a cove at bottom.

C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.17 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.
8. Clean stone trim to comply with stone supplier's written instructions.
9. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."

3.18 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches in each dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04.2000

SECTION 04.4200 - EXTERIOR STONE CLADDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Stone masonry anchored to unit masonry backup.
   2. Stone masonry anchored to cold-formed metal framing and sheathing.

B. Products Installed but Not Furnished under This Section Include:

   1. Steel lintels in unit masonry.
   2. Steel shelf angles for supporting unit masonry.

C. Related Requirements:

   1. Section 04.2000 "Unit Masonry" for masonry backup, coordinated wall mockup, mesh weep/vents, and cavity drainage material.
   2. Division 03 Section "Cast-in-Place Concrete" for concrete supporting construction and installation of embedded anchors furnished under this Section.
   3. Division 05 Section "Cold-Formed Metal Framing" for structural steel-stud backup.
   4. Division 05 Sections "Structural Steel Framing" and "Metal Fabrications" for support steel, lintels, shelf angles, and embedded plates specified in those Sections.
   5. Applicable Division 06 or Division 09 section for exterior sheathing.
   6. Division 07 Section "Thermal Insulation" for exterior wall insulation.
   7. Applicable Division 07 section for the specified air and water-resistive barrier and associated transitions.
   8. Division 07 Section "Sheet Metal Flashing and Trim" for sheet-metal flashing and drip edges.
   9. Section 07.9200 "Joint Sealants" for sealants, primers, joint backing, bond breakers, and sealant testing.

1.3 DEFINITIONS

A. Definitions contained in ASTM C119 apply to this Section.

B. IBC: International Building Code.

C. Stone Cladding Assembly: An exterior wall covering system consisting of stone panels[and trim] together with anchors, backup structure, secondary weather barrier (sheathing), mortar, fasteners, and sealants used to secure the stone to the building structure and to produce a weather-resistant covering.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each variety of stone, stone accessory, and manufactured product.

B. Shop Drawings: Show fabrication and installation details for stone cladding assembly, including dimensions and profiles of stone units.

1. Show locations and details of joints both within stone cladding assembly and between stone cladding assembly and other construction.
2. Include details of mortar joints, sealant joints, and mortar joints pointed with sealant.
3. Show locations and details of anchors and backup structure.
4. Show direction of veining, grain, or other directional pattern.

C. Samples for Initial Selection: For joint materials involving color selection.

D. Stone Samples for Verification: Submit not fewer than five actual stone units representative of the proposed quarry source, showing the full range of color, texture, face configuration, and unit sizes. Include units demonstrating proposed thickness and exposed corner treatment. Samples shall establish the acceptable appearance range, supplemented by the approved wall mockup.

E. Lettering Samples: Submit not fewer than five actual stone units which have full-size incised letters representative of the proposed lettering font. Samples shall show upper case letters in the sizes indicated on the Drawings.

F. Colored Pointing Mortar Samples for Verification: For each color required. Make Samples using same sand and mortar ingredients to be used on Project.

G. Sealant Samples for Verification: For each type and color of joint sealant required.

H. Delegated Design Submittal: For stone cladding assembly.

I. Installation Instructions: Submit stone fabricator's installation instructions and field erection or setting drawings; indicate panel identifying marks and locations on setting drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, fabricator, professional engineer, and testing agency.

B. NSI Installer Qualification: Submit documentation of current Natural Stone Institute Commercial B or Commercial A accreditation for the firm performing stone installation.

C. Welding certificates.

D. Material Test Reports:

1. Stone Test Reports: Submit reports prepared by an independent qualified testing agency for representative specimens of the proposed stone from the quarry source supplying the Project. Include quarry identification, stone designation, sampling and testing dates, specimen descriptions, conditioning, orientation relative to bedding where applicable, individual test results, and reported averages. Provide the following:
    a. Absorption and Bulk Specific Gravity: ASTM C97/C97M; include corresponding dry density.
    b. Compressive Strength: ASTM C170/C170M.
    c. Modulus of Rupture: ASTM C99/C99M.
    d. Flexural Strength: ASTM C880/C880M, where required by the delegated-design engineer.
    e. Strength of Individual Stone Anchorages: ASTM C1354/C1354M, where required to substantiate drilled, kerfed, or other individual stone attachments used in the delegated design.
2. Submit supplier certification identifying the applicable ASTM C568/C568M limestone classification and demonstrating compliance with its physical-property requirements, except abrasion resistance for vertical wall applications.
3. Submit documentation of satisfactory exterior performance of the proposed stone in climates with freezing conditions comparable to the Project location.
4. Submit Project-specific test reports for representative specimens from the quarry source proposed to supply the Work. Obtain required testing at Contractor's expense. Previously published supplier data may supplement, but shall not replace, the required Project-specific testing.
5. Sealant Compatibility and Adhesion Test Report: From sealant manufacturer complying with requirements in Section 07.9200 "Joint Sealants" and indicating that sealants will not stain or damage stone. Include interpretation of test results and recommendations for primers and substrate preparation needed for adhesion.

E. Preconstruction test reports.

F. Source quality-control reports.

G. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.7 QUALITY ASSURANCE

A. Engineering Responsibility: Engage a qualified professional engineer licensed in the Commonwealth of Pennsylvania to design stone veneer ties, anchors, fasteners, and supports furnished under this Section. Base the design on the construction and structural design criteria indicated on the Drawings and the performance requirements of this Section. Submit signed and sealed calculations and Shop Drawings identifying load paths, connection capacities, attachment details, and provisions for differential movement. Coordinate connections to building construction and submit support reactions for review by the Structural Engineer of Record

B. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate stone cladding assemblies similar to that required for this Project and whose products have a record of successful in-service performance.

C. Installer Qualifications: A firm holding current Natural Stone Institute Commercial B or Commercial A accreditation, experienced in installing full-bed anchored stone masonry veneer similar in material, construction, and extent to the Work, and having a record of successful in-service performance. Maintain accreditation throughout installation.

D. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel AWS D1.2, "Structural Welding Code - Aluminum AWS D1.3, "Structural Welding Code - Sheet Steel and AWS D1.6, "Structural Welding Code - Stainless Steel."

F. Mockups: Construct the combined brick, stone, and metal wall panel exterior wall mockup specified in Section 04.2000 “Unit Masonry.” Incorporate the stone masonry components and conditions specified below into that mockup. A separate stone mockup is not required.
   1. Specified stone, ashlar arrangement, color blending, mortar color, joint widths, and joint tooling.
   2. Adjacent brick masonry and the indicated brick-to-stone transition.
   3. Representative backup, sheathing, air and water-resistive barrier, insulation, veneer ties, drainage cavity, flashing, weeps, and cavity drainage material.
   4. Window opening with representative frame, stone returns, sill and head conditions, flashing, end dams, and perimeter sealants.
   5. Representative movement joint and shelf-angle support condition, including compressible joint, where occurring in the Work.
   6. Leave portions of concealed construction exposed for review before completing the mockup.
   7. Obtain Architect's approval before proceeding with corresponding Work. Retain approved mockup as the standard for appearance and workmanship.
   8. Approval does not authorize deviations from Contract Documents unless specifically approved by Architect in writing.

9. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Stone Testing: Contractor shall engage and pay an independent qualified testing agency to perform the testing specified under "Stone Test Reports." Furnish representative specimens from the proposed quarry source and include specimen preparation, shipping, initial testing, and required retesting in the Contract Sum. Submit completed reports before fabrication and installation. Submit the delegated-design engineer's evaluation of results used in the attachment design.

B. Preconstruction Sealant Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for compatibility and adhesion testing according to sealant manufacturer's standard testing methods and Section 07.9200 "Joint Sealants," Samples of materials that will contact or affect joint sealants.

C. Preconstruction Field Testing of Sealants: Before installing joint sealants, field test their adhesion to joint substrates according to Section 07.9200 "Joint Sealants."

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store and handle stone and related materials to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breaking, chipping, and other causes.

1. Lift stone with wide-belt slings; do not use wire rope or ropes that might cause staining. Move stone, if required, using dollies with cushioned wood supports.
2. Store stone on wood skids or pallets with nonstaining, waterproof covers. Arrange to distribute weight evenly and to prevent damage to stone. Ventilate under covers to prevent condensation.

B. Deliver sealants to Project site in original unopened containers labeled with manufacturer's name, product name and designation, color, expiration period, pot life, curing time, and mixing instructions for multicomponent materials.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

D. Store aggregates in locations where grading and other required characteristics can be maintained and where contamination can be avoided.

1.10 FIELD CONDITIONS

A. Protect stone cladding during erection by doing the following:

1. Cover tops of stone cladding installation with nonstaining, waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress. Extend cover a minimum of 24 inches (600 mm) down both sides and hold securely in place.
2. Prevent staining of stone from mortar, grout, sealants, and other sources. Immediately remove such materials without damaging stone.
3. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on ground and over wall surface.
4. Protect sills, ledges, and projections from mortar and sealant droppings.

B. Stain Prevention: Immediately remove mortar and soil to prevent them from staining stone masonry face.

1. Protect base of walls from rain-splashed mud and mortar splatter using coverings spread on the ground and over the wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at end of each day to prevent rain from splashing mortar and dirt on completed stone masonry.

C. Cold-Weather Requirements: Comply with cold-weather construction and protection requirements of TMS 602-16. Do not use frozen materials or materials containing ice or frost. Protect newly installed masonry from freezing and remove and replace masonry damaged by freezing.

D. Hot-Weather Requirements: Comply with hot-weather construction and protection requirements of TMS 602-16, including requirements for material temperatures, mortar preparation and use, and protection of newly installed masonry.

E. Environmental Limitations for Sealants: Do not install sealants when ambient and substrate temperatures are outside limits permitted by sealant manufacturer or below 40 deg F (5 deg C) or when joint substrates are wet.

1.11 COORDINATION

A. Coordinate installation of inserts that are to be embedded in concrete or masonry, flashing reglets, and similar items to be used by stone cladding Installer for anchoring, supporting, and flashing of stone cladding assembly. Furnish setting drawings, templates, and directions for installing such items and deliver to Project site in time for installation.

B. Time delivery and installation of stone cladding to avoid extended on-site storage and to coordinate with work adjacent to stone cladding.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Stone: Obtain each variety of stone, regardless of finish, from single quarry, whether specified in this Section or in another Section of the Specifications, with resources to provide materials of consistent quality in appearance and physical properties.

1. For stone types that include same list of varieties and sources, provide same variety from same source for each.
2. Make quarried blocks available for examination by Architect.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of uniform quality for each cementitious component from single manufacturer and each aggregate from single source or producer.

C. Source Limitations for Other Materials: Obtain each type of stone accessory, sealant, and other material from single manufacturer for each product.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01.4000 "Quality Requirements," to design stone cladding assembly.

B. Design Basis: Design anchored stone masonry veneer and its ties, anchors, fasteners, and supports in accordance with the governing building code and applicable provisions of TMS 402. Apply ASTM C1242 to individual stone attachment systems where used. Provide a complete load path for gravity and lateral loads and accommodate differential movement between veneer and supporting construction.

C. Structural Performance: Stone cladding assembly withstands the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Wind Loads: Design veneer, ties, anchors, fasteners, and supports for the positive and negative component-and-cladding wind pressures indicated on the Structural Drawings, including applicable wall zones and effective wind areas.

D. Seismic Performance: Stone cladding assembly withstands the effects of earthquake motions determined according to ASCE/SEI 7

1. Component Importance Factor: 1.0.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

F. Horizontal Building Movement (Interstory Drift): Allow for maximum horizontal building movement equal to quotient resulting from dividing floor-to-floor height at any floor by 400.

G. Shrinkage and Creep: Allow for progressive vertical shortening of building frame equal to 1/8 inch in 10 feet (3 m).

H. Stone Strength: Determine allowable stone stresses from representative testing of the proposed stone, using the test method, specimen conditioning, and bedding orientation applicable to the design condition:
1. Apply a minimum factor of safety of 8 to stone flexural failure
2. Apply a minimum factor of safety of 10 to localized stone failure at individual drilled or kerfed anchor connections; substantiate connection strength by ASTM C1354/C1354M testing.
3. Increase safety factors where warranted by stone variability, exposure, connection geometry, or other conditions identified by the delegated-design engineer.
4. Design mortar-jointed masonry veneer for applicable compression and bearing requirements of TMS 402. Design metal components and fasteners under the applicable material and anchorage standards.

I. Design stone anchors and backup structure to withstand loads indicated without exceeding allowable working stresses established by the following:

1. For Structural Steel: AISC 360.
2. For Cold-Formed Steel: AISI's "North American Specification and Commentary for the Design of Cold-Formed Steel Structural Members."
3. For Cold-Formed Stainless Steel: ASCE/SEI 8, "Specification for the Design of Cold-Formed Stainless Steel Structural Members."
4. For Cast-in-Place and Postinstalled Anchors in Concrete: Determine design strength and allowable loads in accordance with the governing building code, applicable provisions of ACI 318, and the anchor system's evaluation report, as applicable. Account for substrate strength, cracking, embedment, edge distances, spacing, load combinations, and governing failure modes.
5. For Postinstalled Anchors in Masonry: Determine design strength and allowable loads using the governing building code and an evaluation report applicable to the actual masonry units, grout condition, embedment, edge distances, spacing, and loading. Do not use capacities established for concrete as capacities for masonry.

J. Limit deflection in each prefabricated assembly caused by indicated loads and thermal movements, acting singly or in combination with one another, to not more than 1/720 ratio> of assembly's clear span or the following, whichever is smaller:

1. 1/16 inch (1.5 mm), measured in plane of wall.
2. 1/4 inch (6 mm), measured perpendicular to wall.

K. Provisions for Fabrication and Erection Tolerances: Allow for fabrication and erection tolerances of building's structural system. Concrete fabrication and erection tolerances are specified in Section 03.3000 "Cast-in-Place Concrete. Structural-steel fabrication and erection tolerances are specified in Section 05.1200 "Structural Steel Framing.

L. Provision for Deflection of Building Structure:

1. Deflection Due to Weight of Stone Cladding Assembly: Allow for 1/4-inch (6-mm) vertical deflection in 20-foot (6-m) span of structural members supporting stone cladding assembly.
2. Live Load Deflection: Allow for 1/4-inch (6-mm) vertical deflection, in 20-foot (6-m) span of structural members supporting stone cladding assembly, due to live loads imposed on building's structural frame after stone installation.

M. Corrosion and Staining Control: Prevent galvanic and other forms of corrosion as well as staining by isolating metals and other materials from direct contact with incompatible materials. Materials do not stain exposed surfaces of stone and joint materials.

2.3 QUARTZITIC LIMESTONE

A. Material: Natural Dimension Limestone Masonry:
1. Seneca Limestone® Arctic Ashlar, as manufactured or supplied by Rolling Rock Building Stone, Inc., 40 Rolling Rock Road, Boyertown, PA 19512; telephone (610) 987-6226. Provide stone matching approved samples in color, texture, finish, thickness, and ashlar pattern.
2. Stone standard: ASTM C568/C568M, Limestone Dimension Stone, Physical Requirements—Classification: to be confirmed by testing and supplier certification.
3. Compressive strength: ASTM C170/C170M; submit certified test results for the proposed stone.
4. Absorption and density: ASTM C97/C97M; submit certified test results.
5. Modulus of rupture: ASTM C99/C99M, where required by the structural design.
6. Freeze-thaw durability: ASTM C666/C666M or another project-approved durability procedure, as required for the exposure.
7. Thickness: 4 inches nominal; provide the manufacturer’s permitted tolerance and do not use pieces below the approved minimum thickness.
8. Unit weight: Submit dry density or unit weight from ASTM C97/C97M testing for use in wall dead-load calculations.
9. Anchorage: Design and install anchors, ties, shelf angles, flashing, and mortar joints in accordance with the structural drawings and the applicable provisions of ASTM C1242 and the governing masonry code.

2.4 FRAMING FOR BACKUP STRUCTURE

A. Steel Stud Frames: Galvanized-steel wall framing complying with Section 05.4000 "Cold-Formed Metal Framing."

1. Secondary Weather Barrier (Sheathing): Galvanized-steel sheet complying with ASTM A653/A653M, commercial steel, coating designation G90 (Z275).

2.5 ANCHORS AND FASTENERS

A. Fabricate anchors for limestone, including shelf angles, from stainless steel, ASTM A240/A240M or ASTM A666, Type 304 temper as required to support loads imposed without exceeding allowable design stresses. Fabricate dowels and pins for anchors from stainless steel, ASTM A276, Type 304.

B. Cast-in-Place Concrete Inserts: Provide cast-in-place anchor channels, threaded inserts, or other engineered embedded anchor systems selected and designed by the delegated-design engineer for the indicated concrete construction and loads. Provide stainless-steel components or hot-dip galvanized ferrous components suitable for the exposure. Provide compatible bolts, nuts, washers, and shims. Indicate insert configuration, embedment, attachment details, corrosion protection, and design capacities in the delegated-design submittal. Coordinate placement with concrete reinforcement and supporting construction.

C. Postinstalled Anchors for Concrete and Masonry: Provide corrosion-resistant anchor systems selected and designed by the delegated-design engineer for the actual substrate, loading, and exposure conditions. Provide stainless-steel exposed and embedded metallic components unless otherwise indicated.
1. Use anchor systems with a current evaluation report acceptable to the authority having jurisdiction and applicable to the substrate and installation conditions.
2. Select anchors qualified for cracked concrete, seismic loading, and grouted or ungrouted masonry where applicable to the design.
3. Indicate anchor type, size, material, embedment, spacing, edge distances, installation requirements, and design capacities in the delegated-design submittal.
4. Install according to the anchor manufacturer's written instructions and applicable evaluation report.

D. Threaded Fasteners: Provide stainless-steel bolts, hex cap screws, and studs complying with ASTM F593, and compatible nuts complying with ASTM F594, Alloy Group 1, Type 304, unless otherwise required by the delegated design. Provide stainless-steel washers and shims of compatible alloy. Determine fastener dimensions, configuration, mechanical properties, and washer hardness by delegated design. Where Type 316 stainless steel is required, provide Alloy Group 2 bolts and nuts with compatible washers and shims.

E. Weld Plates for Installation in Concrete: Comply with Section 05 5000 "Metal Fabrications."

F. Anchored Stone Veneer Tie System: Provide adjustable, two-piece stainless-steel veneer anchors and ties suitable for the indicated backup construction and for embedment in stone masonry mortar joints. Provide Type 304 stainless-steel sheet components complying with ASTM A240/A240M and stainless-steel wire components complying with ASTM A580/A580M.
   1. At cold-formed steel framing, fasten anchors to structural studs through sheathing using fasteners designed for the indicated stud thickness. Provide extensions or stand-off components suitable for the insulation thickness and cavity width.
   2. At unit masonry backup, provide anchors embedded in masonry joints or postinstalled into masonry, as appropriate to the indicated construction and delegated design.
   3. Determine anchor and tie configuration, wire diameter, spacing, embedment, fasteners, and additional anchorage at openings and edges by delegated design. Comply with applicable code limitations and TMS 402 requirements.
   4. Accommodate differential movement while transferring lateral loads. Maintain required drainage clearances, minimize displacement or compression of insulation, and seal penetrations of the air and water-resistive barrier with compatible materials

2.6 MORTAR MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or Type II, white.

B. Hydrated Lime: ASTM C207, Type S.

C. Mortar Aggregate: ASTM C144; clean, washed aggregate of consistent grading and color suitable for the specified joint widths.

D. Mortar Pigments: ASTM C979/C979M; mineral pigments compounded for use in masonry mortar, nonfading, and having a record of satisfactory performance.

E. Water: Potable.

F. Packaged Mortar: Factory-preblended portland cement-lime mortar containing the specified materials and proportioned to comply with ASTM C270, Type N, Proportion Specification, may be used. Provide manufacturer's documentation of ingredients and compliance.

2.7 STONE ACCESSORIES

A. Setting Shims: Strips of resilient plastic or vulcanized neoprene, Type A Shore durometer hardness of 50 to 70, nonstaining to stone, of thickness needed to prevent point loading of stone on anchors and of depths to suit anchors without intruding into required depths of pointing materials.

B. Setting Buttons: Resilient plastic buttons, nonstaining to stone, sized to suit joint thicknesses and bed depths of stone units without intruding into required depths of pointing materials.

C. Concealed Sheet Metal Flashing: Fabricated from zinc-tin, alloy-coated stainless steel in thicknesses indicated, but not less than 0.036 inch (0.91 mm) thick, and complying with Section 07 6200 "Sheet Metal Flashing and Trim."

D. Mesh Weep/Vents: Nonmetallic, open-mesh CavClear weep vents specified in Section 04.2000 "Unit Masonry," Paragraph 2.10.D.1.

E. Cavity Drainage Material: Mortar Net USA, Ltd.; Mortar Net, specified in Section 04.2000 "Unit Masonry," Paragraph 2.10.E.1.b.

F. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, of length required to extend from exterior face of stone to cavity behind, in color selected from manufacturer's standard.

G. Wicking Material: Absorbent rope, made from cotton or UV-resistant synthetic fiber, 1/4 to 3/8 inch (6 to 10 mm) in diameter, of length required to produce 2-inch (50-mm) exposure on exterior and 18 inches (450 mm) in cavity between wythes.

H. Sealants for Joints in Stone Masonry: Nonstaining, neutral-curing silicone sealant complying with ASTM C920, Type S, Grade NS, Class 50, Use NT, and applicable substrate-use classifications. Provide sealants, primers, backing materials, and bond breakers complying with Section 07.9200 "Joint Sealants."
   1. Demonstrate nonstaining performance on the proposed stone by ASTM C1248 testing and verify adhesion and compatibility with materials contacting the sealant.
   2. Select sealant movement capability and joint dimensions to accommodate calculated movement. Provide higher movement classification where required by the design.
   3. Color: As selected by Architect.

2.8 FABRICATION OF STONE

A. General: Fabricate stone units in sizes and shapes required to comply with requirements indicated.

B. Control depth of stone and back check to maintain minimum clearance of 1 inch (25 mm between backs of stone units and surfaces or projections of structural members, fireproofing (if any), backup walls, and other work behind stone.

C. Cut and drill sinkages and holes in stone for anchors, fasteners, supports, and lifting devices as indicated or needed to set stone securely in place.

D. Dress joints (bed and vertical) straight and at right angle to face unless otherwise indicated. Shape beds to fit supports.

E. Finish exposed faces and edges of stone, except sawed reveals, to comply with requirements indicated for finish and to match approved samples and mockups.

F. Quirk-miter corners unless otherwise indicated; provide for cramp anchorage in top and bottom bed joints of corner pieces.

G. Select and trim stone to provide mortar joints 1/2 inch nominal in width, with variations permitted under "Installation of Stone Masonry," and to match the approved mockup.

H. Cut stone to produce uniform joints 3/8 inch (10 mm) wide and in locations indicated.

I. Contiguous Work: Provide chases, reveals, reglets, openings, and similar features as required to accommodate contiguous work.

J. Fabricate molded work, including washes and drips, to produce stone shapes with a uniform profile throughout entire unit length, with precisely formed arris slightly eased to prevent snipping, and with matching profile at joints between units.

K. Fabricate molded work, including washes and drips, to produce stone shapes with a uniform profile throughout entire unit length, with precisely formed arris slightly eased to prevent snipping, and with matching profile at joints between units.

L. Incised Lettering and Graphics: Shop-fabricate lettering and graphics in limestone panels where indicated, with true V-shaped recessed profiles, sharp, clean edges, and smoothly finished cut surfaces. Produce by CNC stone cutting, with hand finishing as required to match approved sample. Abrasive blasting and laser etching are not permitted as substitutes for carved V-cut profiles.

1. Submit shop drawings showing complete wording and graphics, font, character heights, stroke widths, spacing, alignment, location relative to panel joints and edges, and dimensioned incision profiles and depths. Coordinate incisions with panel anchorage and required remaining stone thickness.
2. Before production, submit a sample in specified limestone incorporating representative full-size letters and portions of graphics, demonstrating incision profile, depth, workmanship, and completed color treatment. Obtain Architect’s approval before fabricating production panels.
3. Lettering Color Treatment: Provide exterior stone-lettering coating recommended in writing by coating manufacturer for application to specified limestone and exposure conditions; resistant to ultraviolet light, weathering, and alkalinity. Color and sheen shall be selected by Architect from manufacturer’s full range. Prepare recessed surfaces and apply compatible primer, where required, and finish coats according to manufacturer’s written instructions to provide uniform, opaque coverage. Confine coating to recessed surfaces; preserve V-cut profiles and prevent bleeding, staining, or coating of adjacent exposed stone faces.
4. Font: Century Gothic

2.9 FABRICATION OF BACKUP STRUCTURE

A. Fabrication of Miscellaneous Steel Framing Fabricate in shop to comply with AISC 303.

1. Weld shop connections to comply with applicable provisions of AWS D1.1/D1.1M.
2. Fabricate joints to exclude water or to permit its escape to building exterior, at locations where water could accumulate because of condensation or other causes.
3. Hot-dip galvanize backup structure after fabrication to comply with ASTM A123/A123M.

B. Fabrication of Steel Stud Frames: Fabricate and assemble by welding to comply with requirements in Section 054000 "Cold-Formed Metal Framing."

1. Weld secondary weather barrier (sheathing) to outside face of steel stud frames. Use continuous welds at all four edges of sheets to provide continuous weather seal.
2. Clean welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

2.10 SHOP-PAINTED STEEL FINISHES

A. General: Paint uncoated steel backup structure before delivering to Project site to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel."

B. Surface Preparation: After fabricating steel items, prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

C. Apply one coat of fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#76. After primer has dried, apply one coat of exterior alkyd enamel complying with MPI#96 of a different color than primer.

2.11 MORTAR MIXES

A. General: Prepare mortar in accordance with ASTM C270, Proportion Specification, TMS 602, and packaged-mortar manufacturer's written instructions where applicable.

1. Mechanically mix mortar to produce uniform consistency and color. Measure ingredients consistently and maintain approved proportions throughout the Work.
2. Do not use calcium chloride, antifreeze compounds, or admixtures other than specified pigments unless approved by Architect.
3. Retemper and use mortar within the time limits permitted by TMS 602. Discard mortar that has reached initial set.

B. Setting Mortar: Portland cement-lime mortar, ASTM C270, Type N, Proportion Specification.

C. Pointing Mortar: Portland cement-lime mortar, ASTM C270, Type N, Proportion Specification; color as selected by Architect from approved samples.

1. Produce selected color using white portland cement, aggregate, and pigments as required. Maintain consistent materials and proportions.
2. Do not exceed pigment manufacturer's recommended dosage or 10 percent of portland cement weight, whichever is less.
3. Match approved mortar samples and wall mockup.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive stone cladding and conditions under which stone cladding will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of stone cladding.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of stone cladding.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF BACKUP STRUCTURE

A. Installing Miscellaneous Steel Framing: Comply with AISC 303 and install to accommodate construction tolerances specified.

1. Maintain erection of backup structure within tolerances in AISC 303.
2. For prefabricated units to which stone has been installed before erection, maintain tolerances of stone faces and edges as specified in "Installation Tolerances" Article.
3. Install by welding to steel weld-plates anchored in concrete.
4. Clean welds, bolted connections, and abraded areas immediately after erection.

    a. Repair galvanizing to comply with ASTM A780/A780M.
    b. Apply paint to exposed areas using same material as used for shop painting.

3.3 INSTALLATION OF STONE MASONRY

A. Perform necessary field cutting and trimming as stone is set.
1. Use hammer and chisel to split stone that is fabricated with split surfaces. Make edges straight and true, matching similar surfaces that were shop or quarry fabricated.
2. Pitch face at field-split edges as needed to match stones that are not field split.

B. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.

C. Arrange stones in broken-range ashlar pattern with a limited range of course heights, random lengths, and uniform joint widths. Maintain predominantly horizontal stone proportions and intermittent horizontal coursing; interrupt courses with occasional larger stones. Stagger vertical joints, distribute stone sizes evenly, and avoid repetitive arrangements, clusters of small stones, and narrow filler pieces.

D. Arrange stones with color and size variations uniformly dispersed for an evenly blended appearance.

E. Install supports, fasteners, and other attachments indicated or necessary to secure stone masonry in place.

F. Set stone accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

G. Install steel lintels where indicated. Provide minimum bearing of 8 inches (200 mm) at each jamb unless otherwise indicated.

H. Maintain mortar joints 1/2 inch nominal in width. Accommodate natural variations in stone edges with joints not less than 3/8 inch at narrowest points or more than 3/4 inch at widest points. Match the approved mockup.

I. Provide sealant joints of widths and at locations indicated.

1. Keep sealant joints free of mortar and other rigid materials.
2. Sealant joints are specified in Section 07.9200 "Joint Sealants."

J. Install embedded flashing and weep holes at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

1. At metal stud-framed walls, extend flashing through stone masonry, up sheathing face at least 12 inches (300 mm), and behind weather barrier.
2. At multiwythe masonry walls, including cavity walls, extend flashing through stone masonry, turned up a minimum of 12 inches (300 mm), and extend into or through inner wythe to comply with requirements in Section 04.2000 "Unit Masonry."
3. At lintels and shelf angles, extend flashing full length of angles and not less than 8 inches (205 mm) into masonry at each end.
4. At sills, extend flashing not less than 4 inches (100 mm) at ends.
5. At ends of head and sill flashing, turn up not less than 2 inches (50 mm) to form end dams.
6. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches (38 mm) or as recommended by flashing manufacturer, and seal lap with

elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.

7. Install metal drip edges with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 07.9200 "Joint Sealants" for application indicated.
8. Extend sheet metal flashing 1/2 inch (13 mm) beyond masonry face at exterior, turn flashing down and hem the edge of the flashing to form a drip.
9. Install metal drip edges beneath flexible flashing at exterior wall face. Stop flexible flashing 1/2 inch (13 mm) back from exterior wall face and adhere flexible flashing to top of metal drip edge.

K. Place weep holes and vents in joints where moisture may accumulate, including at base of cavity walls, above shelf angles, and at flashing.

1. Form weep openings with the mesh weep/vents specified in this Section. Install above flashing with continuous drainage paths from the cavity to the exterior.
2. Use wicking material to form weep holes above flashing in stone sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
3. Space weep holes 24 inches (600 mm) o.c.
4. Install cavity drainage material above flashing in accordance with manufacturer's written instructions, sized for the indicated cavity and arranged to prevent mortar droppings from obstructing drainage and weep openings.

3.4 INSTALLATION OF STONE CLADDING WITH MORTAR

A. Set stone cladding with mortar and mechanical anchors unless otherwise indicated.

B. Set stone in full bed of mortar with head joints filled unless otherwise indicated.

1. Use setting buttons of adequate size, in sufficient quantity, and of thickness required to maintain uniform joint width and to prevent mortar from extruding. Hold buttons back from face of stone a distance at least equal to width of joint, but not less than depth of pointing materials.
2. Do not set heavy units or projecting courses until mortar in courses below has hardened enough to resist being squeezed out of joint.
3. Support and brace projecting stones until wall above is in place and mortar has set.
4. Provide compressible filler in ends of dowel holes and bottoms of kerfs to prevent end bearing of dowels and anchor tabs on stone. Fill remainder of anchor holes and kerfs with mortar.

C. Maintain the drainage cavity indicated on Drawings, free of mortar bridging, grout, and debris. Provide localized grouting only where expressly indicated on Drawings.

D. Embed ends of sills in mortar; leave remainder of joint open until final pointing.

E. Rake out joints for pointing with mortar to depths of not less than 1/2 inch (12 mm). Rake joints to uniform depths with square bottoms and clean sides.

F. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply first layer of pointing mortar in layers not more than 3/8 inch (10 mm) until a uniform depth is formed.

G. Point stone joints by placing pointing mortar in layers not more than 3/8 inch (10 mm). Compact each layer thoroughly and allow to become thumbprint hard before applying next layer.

H. Tool joints with a round jointer having a diameter 1/8 inch (3 mm) larger than width of joint, when pointing mortar is thumbprint hard.

I. Rake out mortar from sealant-pointed joints to depths required for sealant and sealant backing, but not less than 1/2 inch (12 mm). Rake joints to uniform depths with square bottoms and clean sides.

J. Set the following stone cladding with unfilled head joints for installing joint sealants:
   1. Copings.
   2. Sills.
   3. Belt and other projecting courses.

3.5 INSTALLATION OF JOINT-SEALANTS

A. Prepare joints and apply sealants of type and at locations indicated to comply with applicable requirements in Section 07.9200 "Joint Sealants."

3.6 INSTALLATION TOLERANCES

A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet (6 mm in 3 m), or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet (6 mm in 6 m) or more.

B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet (6 mm in 6 m) or more.

C. Variation of Linear Building Line: For position shown in plan, do not exceed 1/2 inch in 20 feet (13 mm in 6 m) or more.

D. Measure variation from level, plumb, and position shown in plan as a variation of the average plane of each stone face from level, plumb, or dimensioned plane.

E. Variation in Mortar-Joint Thickness: Do not vary from joint size range indicated.

F. Variation in Plane between Adjacent Stones: Do not exceed one-half of tolerance specified for thickness of stone.

3.7 MAINTENANCE

A. Submit with Close-Out documents the selected lettering coating product data and touch-up instructions. Provide an unopened container(s) of touch-up paint sufficient in quantity to recoat all of the lettering in the panels.

3.8 ADJUSTING AND CLEANING

A. Protection of Lettering: Protect completed lettering and color treatment during handling, installation, and cleaning. Use cleaning materials and methods compatible with both limestone and lettering coating. After final cleaning, repair damaged color treatment according to coating manufacturer's written instructions to match approved sample; replace panels with chipped lettering or staining that cannot be satisfactorily corrected.

B. Remove and replace broken, chipped, stained, or otherwise damaged stone, defective joints, and stone cladding that does not match approved samples and mockups. Damaged stone may be repaired if Architect approves methods and results.

C. Replace damaged or defective work in a manner that results in stone cladding's matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.

D. In-Progress Cleaning: Clean stone cladding as work progresses. Remove mortar fins and smears before tooling joints. Remove excess sealant and smears as sealant is installed.

E. Final Cleaning: Clean stone cladding no fewer than six days after completion of pointing and sealing, using clean water and stiff-bristle fiber brushes. Do not use wire brushes, acid-type cleaning agents, cleaning agents containing caustic compounds or abrasives, or other materials or methods that could damage stone.

END OF SECTION 04.4200

SECTION 05.1200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural steel.
2. Field-installed shear connectors.
3. Shrinkage-resistant grout.

B. Related Requirements:

1. Section 05.1213 "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.
2. Section 05.3100 "Steel Decking" for field installation of shear connectors through deck.
3. Section 05.5000 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame miscellaneous steel fabrications and other steel items not defined as structural steel.
4. Section 07.8123 “Intumescent Fire Protection” for protection of exposed steel members.
5. Section 09.9600 “High Performance Coatings” for painting exposed Structural Steel Framing in the Natatorium and where indicated on the Drawings.

1.2 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

1.4 Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data:

1. Structural-steel materials.
2. High-strength, bolt-nut-washer assemblies.
3. Anchor rods.
4. Threaded rods.
5. Shop primer.
6. Galvanized-steel primer.
7. Galvanized repair paint.
8. Shrinkage-resistant grout.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing them between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
5. Identify members and connections of the seismic-load-resisting system.
6. Indicate locations and dimensions of protected zones.
7. Identify demand-critical welds.
8. Identify members not to be shop primed.

C. Delegated Design Submittal: For structural-steel connections indicated on Drawings to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, fabricator, shop-painting applicators, testing agency.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Mill test reports for structural-steel materials, including chemical and physical properties.

E. Product Test Reports: For the following:

1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength, bolt-nut-washer assemblies.
4. Shear stud connectors.
5. Shop primers.
6. Nonshrink grout.

F. Survey of existing conditions.

G. Source quality-control reports.

H. Field quality-control reports.

1.8 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).

B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

C. Shop-Painting Applicator Qualifications: Qualified in accordance with AISC's Sophisticated Paint or complying with the requirements of SSPC-QP 3.

D. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with applicable provisions of the following specifications and documents:

1. ANSI/AISC 303.
2. ANSI/AISC 341.
3. ANSI/AISC 360.
4. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

B. Connection Design Information:

1. Option 3 and 3B: Design connections and final configuration of member reinforcement at connections in accordance with ANSI/AISC 303 by fabricator's qualified professional engineer.

a. Use Allowable Stress Design; data are given at service-load level.

C. Moment Connections: **Type PR**, partially restrained.

D. Construction: Combined system of moment frame, braced frame, and shear walls.

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A992/A992M, Grade 50

B. Channels, Angles: ASTM A36/A36M

C. Plate and Bar: ASTM A36/A36M and ASTM A572/A572M, Grade 50 (Grade 345).

D. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade C structural tubing.

E. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH (ASTM A563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F959, Type 325-1 compressible-washer type with plain finish.

B. High-Strength A490 Bolts, Nuts, and Washers: ASTM F3125, Grade A490, Type 1, heavy-hex steel structural bolts, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

C. Zinc-Coated High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers.

1. Finish: Hot-dip or mechanically deposited zinc coating.
2. Direct-Tension Indicators: ASTM F959, Type 325-1, compressible-washer type with mechanically deposited zinc coating finish.

D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125, Grade F1852, Type 1, heavy-hex head assemblies, consisting of steel structural bolts with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

1. Finish: Mechanically deposited zinc coating.

2.4 RODS

A. Headed Anchor Rods: ASTM F1554, Grade 55, weldable, straight.

1. Nuts: ASTM A563 heavy-hex carbon steel.
2. Plate Washers: ASTM A36 carbon steel.
3. Washers: ASTM F436, Type 1, hardened carbon steel.
4. Finish: Plain, Hot-dip zinc coating, ASTM A153, Class C.

B. Threaded Rods: ASTM A36, ASTM A572, Grade 50.

1. Nuts: ASTM A63 hex carbon steel.

2. Washers: ASTM F436**,** Type 1, hardened carbon steel.
3. Finish: Plain, Hot-dip zinc coating, ASTM A153, Class C.

2.5 PRIMER

A. Steel Primer:

1. Comply with Section 09.9113 "Exterior Painting," Section 099123 "Interior Painting," and Section 09.9600 "High-Performance Coatings."
2. SSPC-Paint 23, latex primer.
3. Fabricator's standard lead- and chromate-free, non-asphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

B. Galvanized-Steel Primer: MPI#26.

1. Etching Cleaner: MPI#25, for galvanized steel.
2. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20 ASTM A780/A780M.

2.6 SHRINKAGE-RESISTANT GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.7 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.

1. Cut, drill, or punch holes perpendicular to steel surfaces**.** Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.

G. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.8 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.

1. Joint Type: As required by connection details.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.9 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M.

1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.

2. Galvanize exterior structural steel. Galvanize lintels and shelf angles attached to structural-steel frame and located in exterior walls.

2.10 SHOP PRIMING

A. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Surfaces of high-strength bolted, slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces unless indicated to be painted.
6. Surfaces enclosed in interior construction.

B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:

1. SSPC-SP 3, "Power Tool Cleaning."

C. Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner or in accordance with SSPC-SP 16.

D. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.11 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.

1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
2. Bolted Connections: Inspect[and test] shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

a. Liquid Penetrant Inspection: ASTM E165/E165M.

b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
c. Ultrasonic Inspection: ASTM E164.
d. Radiographic Inspection: ASTM E94/E94M.

4. In addition to visual inspection, test and inspect shop-welded shear stud connectors in accordance with requirements in AWS D1.1/D1.1M.
5. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.

B. Baseplates Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.

3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.

C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.

1. Joint Type: As required by connection details.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.

3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:

1. Verify structural-steel materials and inspect steel frame joint details.
2. Verify weld materials and inspect welds.
3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

1. Bolted Connections: Inspect and test bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.

    a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

        1) Liquid Penetrant Inspection: ASTM E165/E165M.
        2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
        3) Ultrasonic Inspection: ASTM E164.
        4) Radiographic Inspection: ASTM E94/E94M.

C. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

3.6 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780/A 780M.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION 05.1200

SECTION 05.2100 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. K-series steel joists.
2. LH-series long-span steel joists.
3. Steel joist accessories.

B. Related Requirements:

1. Section 05.1213 "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.
2. Section 05.3100 "Steel Decking" for field installation of shear connectors through deck.
3. Section 05.5000 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame miscellaneous steel fabrications and other steel items not defined as structural steel.
4. Section 07.8123 “Intumescent Fire Protection” for protection of exposed steel members.
5. Section 09.9600 “High Performance Coatings” for painting exposed Structural Joists in the Natatorium and where indicated on the Drawings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of joist, accessory, and product.

B. Shop Drawings:

1. Include layout, designation, number, type, location, and spacing of joists.
2. Include joining and anchorage details; bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Manufacturer certificates..

C. Mill Certificates: For each type of bolt.

D. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications."

1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

B. Welding Qualifications: Qualify field-welding procedures and personnel in accordance with AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 STEEL JOISTS

A. K-Series Steel Joist: Manufactured steel joists of type indicated in accordance with "Standard Specification for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.

1. Steel Joist Substitutes: Manufacture in accordance with "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.

B. Long-Span Steel Joist: Manufactured steel joists in accordance with "Standard Specification for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members; of joist type and end and top-chord arrangements as indicated on Drawings.

2.2 STEEL JOIST GIRDERS

A. Manufactured joist girders in accordance with "Standard Specification for Joist Girders" in SJI's "Specifications," with steel-angle top- and bottom-chord members; with end and top-chord arrangements as indicated.

2.3 PRIMERS

A. Primer:

1. SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

2.4 STEEL JOIST ACCESSORIES

A. Bridging:
1. Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability

2.5 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories.

B. Apply one coat of shop primer to joists and joist accessories.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction in accordance with SJI's "Specifications," joist manufacturer's written instructions, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.

C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Bolt joists to supporting steel framework using carbon-steel bolts.

E. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for high-strength structural bolt installation and tightening requirements.

F. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Visually inspect field welds in accordance with AWS D1.1/D1.1M.

C. Visually inspect bolted connections.

D. Prepare test and inspection reports.

END OF SECTION 05.2100

SECTION 05.3100 - STEEL DECK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof deck.
2. Composite floor deck.
3. Acoustic Roof Deck.

B. Related Requirements:

1. Section 05.1213 "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.
2. Section 05.5000 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame miscellaneous steel fabrications and other steel items not defined as structural steel.
3. Section 07.8123 “Intumescent Fire Protection” for protection of exposed steel members.
4. Section 09.9600 “High Performance Coatings” for painting exposed Structural Steel Framing in the Natatorium and where indicated on the Drawings.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Roof deck.
2. Composite floor deck.
3. Acoustic Roof Deck.

B. Shop Drawings:

1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.3 INFORMATIONAL SUBMITTALS

A. Certificates:

1. Welding certificates.
2. Product Certificates: For each type of steel deck.

B. Test and Evaluation Reports:

1. Product Test Reports: For tests performed by a qualified testing agency, indicating that power-actuated mechanical fasteners comply with requirements.
2. Research Reports: For steel deck, from ICC-ES showing compliance with the building code.

C. Field Quality-Control Submittals:

1. Field quality-control reports.

D. Qualification Statements: For welding personnel.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Welding Qualifications: Qualify procedures and personnel in accordance with SDI QA/QC and the following welding code:

a. AWS D1.3/D1.3M.

B. FMG Listing: If required by Owner, provide steel roof deck evaluated by FMG and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings, unless otherwise indicated on documents.

C. Conduits within concrete slabs on composite steel floor Deck: No conduit shall be placed within concrete slabs on metal deck without compliance with the latest version of The Design Manual For Composite Decks, Form Decks, And Roof Decks. The contractor shall notify the architect and obtain written approval prior to any installation.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in accordance with SDI MOC3. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck in accordance with AISI S100.

B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from listings of another qualified testing agency.

2.2 ROOF DECK

A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with SDI RD and with the following.

1. Galvanized- and Shop-Primed Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 40, G60 (Z180) zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.

a. Color: Gray.

2. Deck Profile: As indicated on documents.
3. Profile Depth: As indicated on documents.
4. Design Uncoated-Steel Thickness: As indicated on documents.
5. Span Condition: Triple span or more.
6. Side Laps: Overlapped.

2.3 ACOUSTICAL ROOF DECK

A. Acoustical Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:

1. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 40, G60 (Z180) zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.

a. Color: Gray

2. Deck Profile: As indicated on documents.
3. Profile Depth: As indicated on documents.
4. Design Uncoated-Steel Thickness: As indicated on documents.
5. Span Condition: Triple span or more.
6. Side Laps: Overlapped or interlocking seam at Contractor's option unless otherwise indicated on documents.

7. Acoustical Perforations: Deck units with manufacturer's standard perforated vertical webs.
8. Sound-Absorbing Insulation: Manufacturer's standard premolded roll or strip of glass or mineral fiber.

    a. Factory install sound-absorbing insulation into cells of cellular deck.
    b. Installation of sound-absorbing insulation is specified in Division 07.

9. Acoustical Performance: NRC **0.80** or higher, tested according to ASTM C 423.

2.4 COMPOSITE FLOOR DECK

A. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:

1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 40, G60 (Z180) zinc coating.
2. Profile Depth: As indicated on documents.
3. Design Uncoated-Steel Thickness: As indicated on documents.
4. Span Condition: Triple span or more.

2.5 ACCESSORIES

A. Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

G. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck. For drains, cut holes in the field.

H. Galvanizing Repair Paint: ASTM A780/A780M

I. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install deck panels and accessories in accordance with SDI C, SDI NC, and SDI RD, as applicable; manufacturer's written instructions; and requirements in this Section.

B. Locate deck bundles to prevent overloading of supporting members.

C. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

D. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

E. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

F. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

G. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install in accordance with deck manufacturer's written instructions.

3.2 INSTALLATION OF ROOF DECK

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches (38 mm) long, and as follows:

1. Weld Diameter: 5/8 inch (16 mm), nominal.
2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 12 inches (450 mm) apart maximum or as indicated on documents.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 18 inches (460 mm) and as follows:

1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
2. Mechanically clinch or button punch.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:

1. End Joints: Lapped 2 inches (50 mm) minimum

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld or mechanically fasten flanges to top of deck. Space welds or mechanical fasteners not more than 12 inches (300 mm) apart with at least one weld or fastener at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and weld or mechanically fasten.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels in accordance with deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

F. Sound-Absorbing Insulation: Installation into topside ribs of deck as specified in Division 07.

3.3 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:

1. Weld Diameter: 5/8 inch (16 mm), nominal, or as indicated on documents.
2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches (305 mm) apart, but not more than 18 inches (457 mm) apart, or as indicated on documents.
3. Weld Washers: Install weld washers at each weld location where uncoated steel thickness is less than 0.028 inch (0.71 mm).

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 36 inches (914 mm), with self-drilling No. 10 (4.8 mm) diameter or larger carbon-steel screw or, for deck that is a minimum of 0.0474 inch (1.20 mm) thick, by welding with a minimum of 1-1/2 inch (38 mm) long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:

1. End Joints: Lapped or butted and taped at Contractor's option.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.4 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint in accordance with ASTM A780/A780M and manufacturer's written instructions.

B. Repair Painting:

1. Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.

C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Special inspections and qualification of welding special inspectors for cold-formed steel floor and roof deck in accordance with quality-assurance inspection requirements of SDI QA/QC.

a. Field welds will be subject to inspection.

2. Steel decking will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 05.3100

SECTION 05.5400 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Exterior non-load-bearing wall framing.
2. Interior non-load-bearing wall framing.
3. Ceiling joist framing.
4. Soffit framing.

B. Related Requirements:

1. Section 05.5000 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.
2. Section 09.2117 "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies, with height limitations.
3. Section 09.2216 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, with height limitations and ceiling-suspension assemblies.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Cold-formed steel framing materials.
2. Exterior non-load-bearing wall framing.
3. Interior non-load-bearing wall framing.
4. Vertical deflection clips.
5. Single deflection track.
6. Double deflection track.
7. Drift clips.
8. Ceiling joist framing.
9. Soffit framing.
10. Post-installed anchors.
11. Power-actuated anchors.
12. Sill sealer gasket.

13. Sill sealer gasket/termite barrier.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated Design Submittal: For cold-formed steel framing.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product certificates: For each type of code-compliance certification for studs and tracks.

D. Product test reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency.

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories

E. Research Reports:

1. For post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.
2. For nonstandard cold-formed steel framing post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.
3. For sill sealer gasket/termite barrier, showing compliance with ICC-ES AC380.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Stud Manufacturers Association.

D. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE AND HANDLING

A. Protect and store cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling as required in AISI S202.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Clark Dietrich Metal Framing.
B. MarinoWare Industries.
C. Nucor Building Systems.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated on Drawings.
2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
   a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/600 of the wall height for studs backing up masonry veneers, 1/240 of the wall height for other materials.

b. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/240 of the wall height under a horizontal load of 5 lbf/sq. ft..
c. Ceiling Joist Framing: Vertical deflection of 1/360 of the span for live loads and 1/240 for total loads of the span.

3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
   a. Upward and downward movement of 3/4 inch.
5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing complies with AISI S100 and ASTM C955.

D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings from an applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.3 COLD-FORMED STEEL FRAMING MATERIALS

A. Framing Members, General: Comply with AISI S240 for conditions indicated.

B. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:

1. Grade: As required by structural performance.
2. Coating: G90 or equivalent.

C. Steel Sheet for Vertical Deflection Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance.
2. Coating: G90.

D. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:

1. Grade: As required by structural performance.
2. Coating: G90 or equivalent.

2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0677 inch (1.72 mm).
2. Flange Width: 2 inches (51 mm).

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and matching minimum base-metal thickness of steel studs.

C. Vertical Deflection Clips, Exterior: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Clark Dietrich.
b. Marino\Ware.
c. Nucor Building Systems.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch.
2. Flange Width: 1 inch plus the design gap for one-story structures and 1 inch plus twice the design gap for other applications.

E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
   a. Minimum Base-Metal Thickness: 0.0428 inch.

b. Flange Width: 1 inch plus the design gap for one-story structures and 1 inch plus twice the design gap for other applications.

2. Inner Track: Of web depth indicated, and as follows:
   a. Minimum Base-Metal Thickness: 0.0428 inch.

F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure

2.5 INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
2. Flange Width: 1-5/8 inches (41 mm).

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and matching minimum base-metal thickness of steel studs.

1. Minimum Base-Metal Thickness: 0.0329 inch.
2. Flange Width: 1-1/4 inches.

C. Vertical Deflection Clips, Interior: Manufacturer's standard head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Clark Dietrich.
   b. Marino\Ware.
   c. Nucor Building Systems.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch.
2. Flange Width: 1 inch plus the design gap for one-story structures and 1 inch plus twice the design gap for other applications.

E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.6 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched with standard holes, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0329 inch.
2. Flange Width: 1-5/8 inches, minimum.

2.7 SOFFIT FRAMING

A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0329 inch.
2. Flange Width: 1-5/8 inches, minimum.

2.8 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole-reinforcing plates.
11. Backer plates.

2.9 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.

B. Anchor Bolts: ASTM F1554, Grade 36, threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A153/A153M, Class C.

C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.

1. Uses: Securing cold-formed steel framing to structure.
2. Type: Torque-controlled expansion anchor or adhesive anchor.
3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941 (ASTM F1941M), Class Fe/Zn 5, unless otherwise indicated.
4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 (A4) stainless steel bolts, ASTM F593 (ASTM F738M), and nuts, ASTM F594 (ASTM F836M).

D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.10 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A780/A780M.

B. Cement Grout: Portland cement, ASTM C150/C150M, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time

D. Shims: Load-bearing, high-density or cold-formed steel of same grade and metallic coating as framing members supported by shims.

E. Sill Sealer Gasket: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

F. Sill Sealer Gasket/Termite Barrier: Minimum 68-mil (1.7-mm) nominal thickness, self-adhering sheet consisting of 64 mils (1.6 mm) of rubberized asphalt laminated on one side to a 4-mil-(0.10-mm-) thick, polyethylene-film reinforcement, and with release liner on adhesive side; formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.
   1. Physical Properties:
      a. Peel Adhesion: 17.0 lb/in of width (2.9 N/mm of width) when tested in accordance with ASTM D412.
      b. Low-Temperature Flexibility: Pass at minus 25 deg F (minus 32 deg C) when tested in accordance with ASTM D146/D146M.
      c. Water Vapor Permeance: 0.05 perm (0.44 ng/Pa x s x sq. m) maximum when tested in accordance with ASTM E96/E96M, Method B.
      d. Resistance to Termite Penetration: Comply with ICC-ES AC380.

2.2 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

   1. Fabricate framing assemblies using jigs or templates.
   2. Cut framing members by sawing or shearing; do not torch cut.
   3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.
   4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery,

and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.

C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sill sealer gasket at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

E. Install sill sealer gasket/termite barrier in accordance with manufacturer's written instructions at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in Section 07 2100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 INSTALLATION OF EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure at corners and ends, and at spacings as follows:

1. Anchor Spacing: To match stud spacing and as shown on Shop Drawings.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: 16 inches or as indicated on the Drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.

1. Connect vertical deflection clips to bypassing studs and anchor to building structure.
2. Connect drift clips to cold-formed steel framing and anchor to building structure.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
1. Install single deep-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to bypassing and infill studs and anchor to building structure.
4. Connect drift clips to cold-formed steel framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
1. Channel Bridging: Cold-rolled steel channel welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 18 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

1. Install solid blocking at centers indicated on Shop Drawings.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INSTALLATION OF INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: 16 inches and as indicated on the Drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to studs and anchor to building structure.
4. Connect drift clips to cold-formed steel metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 18 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

1. Install solid blocking at centers indicated on Shop Drawings.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 INSTALLATION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.

3.7 REPAIRS

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

3.8 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05.5400

SECTION 05.5000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes, but is not limited to, the following:

1. Steel framing and supports for operable partitions.
2. Steel framing and supports for overhead doors and grilles.
3. Steel framing and supports for mechanical and electrical equipment.
4. Elevator hoist beams.
5. Elevator Inserts.
6. Support angles for elevator door sills.
7. Elevator pit sump covers
8. Shelf angles.
9. Metal Ladders.
10. Loose steel lintels.
11. Loose bearing and leveling plates.
12. Steel weld plates and angles for casting into concrete not specified in other Sections.
13. Miscellaneous steel trim.
14. Metal bollards.
15. Steel framing and supports for applications where framing and supports are not specified in other Sections.
16. Copper date stone box liner.
17. Metal downspout boots.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

C. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for concrete fill and for installing anchor bolts, steel pipe sleeves, wedge-type inserts and other items indicated to be cast into concrete.

2. Division 4 Section "Unit Masonry Assemblies" for installing loose lintels, anchor bolts, and other items indicated to be built into unit masonry.
3. Division 5 Section "Structural Steel" for structural-steel framing system components.
4. Division 5 Section "Metal Stairs".
5. Division 5 Section "Metal Railings" for metal handrails and railings.
6. Division 6 Section "Rough Carpentry" plywood backing panels for sheet metal fabrications.
7. Division 6 Section "Architectural Woodwork" built-in wood benches.
8. Division 9 Section "Painting and Finishing" painting requirements for exposed metal fabrications.
9. Division 14 Section "Hydraulic Elevators" for elevator pit ladder and support angles for elevator door sills.
10. Divisions 15 and 16 for miscellaneous supports of hangers for equipment, pipes, etc.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 SUBMITTALS

A. Comply with pertinent provisions of Division 1 Section "Submittals."

B. Product Data:

1. Paint Products.
2. Grout.

C. Shop Drawings: Detail fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1. Provide erection plan for loose steel lintels, separate from structural steel submittals, and submit before structural steel shop drawings.
2. Provide templates for anchors and bolts specified for installation under other sections.

D. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.

E. Welding Certificates: Copies of certificates for welding procedures and personnel.

F. Qualification Data: For firms and persons specified in “Quality Assurance” Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code—Sheet Metal."
4. AWS D1.6, "Structural Welding Code—Stainless Steel."
5. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.6 PROJECT CONDITIONS

A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36.

B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.

C. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.

D. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

E. Malleable-Iron Castings: ASTM A 47, Grade 32510 (ASTM A 47M, Grade 22010).

F. Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 malleable iron or ASTM A 27 cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153.

G. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.3 COPPER

A. Copper Sheet: ASTM B 370, Temper H00 or H01, cold-rolled copper sheet.

1. Solder for Copper: ASTM B32, Grade Sn50, 50 percent tin and 50 percent lead.

2.4 ALUMINUM

A. Aluminum Extrusions and Pipe: ASTM B 221, alloy 6063-T6.

2.5 PAINT

A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664: selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

B. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds in steel, complying with SSPC-Paint 20.

C. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

2.6 FASTENERS

A. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A, Property Class 4.6; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36.

1. Anchor Bolts in Concrete and Masonry: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A153, Class C; of diameter and length indicated.
    a. Where in contact with ACQ preservation-treated wood, provide stainless steel bolts and washers complying with ASTM A 276 or ASTM A 666, Type 304; and stainless steel nuts complying with ASTM F 594, Alloy Group 1, CW.

D. Machine Screws: ASME B18.6.3.

E. Lag Bolts: ASME B18.2.1.

F. Wood Screws: Flat head, carbon steel, ASME B18.6.1.

G. Plain Washers: Round, carbon steel, ASME B18.22.1.

H. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1.

I. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Material: Alloy Group 1 or 2 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

J. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as needed.

2.7 GROUT

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.8 CONCRETE FILL

A. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.9 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Shear and punch metals cleanly and accurately. Remove burrs.

C. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

F. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

G. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

H. Allow for thermal movement resulting from change in ambient and surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

I. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

J. Remove sharp or rough areas on exposed traffic surfaces.

K. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

L. Date Stone Box Liner: Copper; 16 oz. / sq. ft.

2.10 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates after fabrication.

2.11 LOOSE STEEL LINTELS

A. Fabricate loose structural-steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

B. Weld adjoining members together to form a single unit where indicated.

C. Size loose lintels to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 8 inches, unless otherwise indicated.

D. Galvanize loose steel lintels located in exterior walls.

2.12 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports that are not a part of structural-steel framework as necessary to complete the Work.

B. Fabricate units from structural-steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors 1-1/4 inches wide by 1/4 inch thick by 8 inches long at 24 inches on center, unless otherwise indicated.
2. Furnish inserts if units must be installed after concrete is placed.

C. Fabricate supports for toilet compartments as follows:

1. Vertical Reinforcing Members: Continuous steel tubes, not less than 3 inches square, or another shape with equivalent structural properties.
2. Braces and Angles: Steel angles of size and required for rigid support of vertical supports and for secure anchorage to structure.

D. Galvanize miscellaneous framing and supports where indicated.

2.13 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from structural-steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6 inches from each end, 6 inches from corners, and 24 inches on center, unless otherwise indicated.

C. Galvanize exterior use miscellaneous steel trim as noted in Construction Documents.

2.14 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.15 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123, for galvanizing steel and iron products.
2. ASTM A 153, for galvanizing steel and iron hardware.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications.

C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

2.16 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. Polish below is usual stainless-steel finish and references standard sheet finish designation. Revise if another finish is required.

D. Bright, Directional Polish: No. 4 finish.

E. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.17 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class I, Clear Anodic Finish: AA-M12C22A41 Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker complying with AAMA 607.1.

PART 3 - EXECUTION

3.1 COORDINATION

A. This fabricator shall secure and be responsible for all field measurements required for the proper and accurate fabrication and installation of the items included in this Section. Field alterations will not be permitted, except upon specific authorization of the Architect.

B. Coordinate with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.2 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

E. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

G. Install pipe railings and handrails at walls and stairs unless otherwise indicated or approved by the Architect in accordance with the following:

1. Provide cast brackets having 2 ¼ inch minimum clearance between railing and wall;
2. Return handrail ends to within 1/2 inches of wall;
3. Secure to wall with approved fasteners.
4. Weld guard rails to stringers as indicated on the Drawings;
5. At top and bottom of stairs and ramps continue handrail 24 inches past first and last riser. Return ends to within ½-inch of wall.

3.3 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings, if any.

3.4 INSTALLING NOSINGS, TREADS, AND THRESHOLDS

A. Center nosings on tread widths unless otherwise indicated.
B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.
C. Seal thresholds exposed to exterior with elastomeric sealant complying with Section 07.9200 “Joint Sealants” to provide a watertight installation.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

C. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

D. Protect factory-applied finishes from damage during construction period. Remove temporary protective coverings at time of Substantial Completion.

END OF SECTION 05.5000

SECTION 05.5100 – METAL PAN STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Preassembled metal pan stairs with concrete-filled treads.

B. Related Sections include the following:

1. Division 03 Section “Cast-In-Place Concrete” for concrete fill for stair treads and platform.
2. Division 05 Section “Metal Fabrications”
3. Division 09 Section “Painting.”

1.3 PERFORMANCE REQUIREMENTS

A. Structural performance: Provide metal stairs capable of withstanding the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each component of metal stairs.

1. Treads and Platforms of Metal Stairs: Capable of withstanding a uniform load of 100 pound foot per square foot, or a concentrated load of 300 pound foot on an area of 4 square inches, whichever produces the greater stress.
2. Stair Framing: Capable of withstanding stresses resulting from loads specified above in addition to stresses resulting from railing system loads.
3. Limit deflection of treads, platforms, and framing members to L/360 or ¼-inch.
4. Handrails and Top Rails: Concentrated load of 200 pounds applied at any point in any direction or a uniform load of 50 pounds per linear foot applied simultaneously in both vertical and horizontal directions.

1.4 SUBMITTALS

A. Product data:

1. Materials list of items proposed to be provided under this Section;
2. Manufacturer's catalog cuts or other data needed to prove compliance with stair nosing;
3. Shop primer paint.

B. Shop Drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Delegated – Design Submittal: For stairs, railings, and guards, including analysis data signed and sealed by the qualified professional engineer responsible for the preparation.

1.5 QUALITY ASSURANCE

A. Perform shop and/or field welding required in connection with the work of this Section in strict accordance with pertinent recommendations of the American Welding Society.

B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.

1.6 COORDINATION

A. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01.4000 "Quality Requirements," to design stairs, **railings and guards**, including attachment to building construction.

B. Structural Performance of Stairs: Metal stairs withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing and guard loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to **L/360** or 1/4 inch (6.4 mm), whichever is less.

C. Refer to Section 05.5200 “Metal Railings” for Structural Performance of Railings and Guards and their attachments to building construction.

D. Seismic Performance of Stairs: Metal stairs withstand the effects of earthquake motions as determined according to the Earthquake Design Data indicated on the Drawings.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.3 MATERIALS

A. Except as otherwise indicated on the Drawings, provide materials as required for the Work and complying with the following minimum standards.

1. Rolled steel shapes, wide flanges and channels: Comply with ASTM A 992 (Fy = 50 ksi.)
2. Rolled angles, plates and bars: Comply with ASTM A 36.
3. Metal pans: Form risers and sub-treads from 12 gage hot-rolled steel complying with ASTM A 569 or ASTM A 570;
4. Sheet steel: Comply with following as appropriate:
   a. Galvanized: ASTM A 653, coating G90;

b. Landings: Cold-rolled 12 gage steel complying with ASTM A 366;

5. Steel plate:
   a. Except for plates to be bent or cold-formed, comply with ASTM A 36;
   b. For plates to be bent or cold-formed, comply with ASTM A 283, Grade C;
6. Newel posts: Use steel tube complying with ASTM A 500;
7. Steel pipes: Comply with ASTM A 53, Type E or S, Grade B; Schedule 40;
8. Bolts and nuts for anchoring to structural steel: High strength bolts complying with ASTM A 325, Type F;
9. Machine bolts, nuts, and washers: Comply with ASTM A 307, Grade A;
10. Steel bars and bar-size shapes:
    a. Hot-rolled carbon steel bars and bar-size shapes, comply with ASTM A 575 in grade as selected by the fabricator;
    b. For other steel bars and bar-size shapes, comply with ASTM A 663 or ASTM A 36;
11. Wire fabric (reinforcing):
    a. Comply with ASTM A 185, plain cold-drawn steel welded wire mesh size 2 inches by 2 inches by 12 gage wires in both directions;
    b. Tack weld to inside of steel pan treads and landing;
12. Arc-welding electrodes: Comply with AWS A5.1, using E60XX or E70XX series as required for the intended use;
13. Shop primer: Use "10-99 Tnemec Primer" by Tnemec Company, Inc., Kansas City, MO; or "1069 Primer" by Rust-Oleum Corporation, Vernon Hills, IL; or equal product of alternatives of the quality necessary to meet the specifications.

2.4 ABRASIVE NOSINGS

A. Cast-Metal Units: Cast [**iron**] [**aluminum**] [**bronze**] [**nickel silver**], with an integral abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in lengths necessary to accurately fit openings or conditions.
   1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
   2. <Double click to insert sustainable design text for recycled content.>
   3. Configuration: Cross-hatched units, [**3 inches (75 mm)**] [**4 inches (100 mm)**] wide without lip.

B. Extruded Units: [**Aluminum**] [**Bronze**] units with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.
   1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
   2. <Double click to insert sustainable design text for recycled content.>
   3. Provide ribbed units, with abrasive filler strips projecting 1/16 inch (1.5 mm) above aluminum extrusion.
   4. Provide solid-abrasive units without ribs.

5. Nosings, Square-Back Units: [**1-7/8 inches (48 mm)**] [**3 inches (75 mm)**] [**4 inches (100 mm)**] wide, without lip.
6. Nosings, Two-Piece Units: 3 inches (75 mm) wide, with subchannel for casting into concrete.

C. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

D. Apply bituminous paint to concealed surfaces of cast-metal units set into concrete.

E. Apply clear lacquer to concealed surfaces of extruded units set into concrete.

2.5 FASTENERS

A. General: Provide Type 304 stainless steel fasteners complying with ASTM F593 and ASTM F594.
1. Select fasteners for type, grade, and class required.

B. Fasteners for Anchoring Railings and Guards to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings and guards to other types of construction indicated and capable of withstanding design loads.

C. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.

D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.
1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for exterior stairs.

E. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1), (Type 304) stainless steel bolts, ASTM F593, and nuts, ASTM F594 (ASTM F836M).

2.6 MISCELLANEOUS MATERIALS

A. Welding Electrodes: Comply with AWS requirements.

B. Shop Primers: Provide primers that comply with Section 099113 "Painting" and Section 099600 "High-Performance Coatings."

C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
   1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish system indicated.

E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 ASTM A780/A780M and compatible with paints specified to be used over it.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

G. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for interior use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.

2.7 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation.

2.8 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

   1. Join components by welding, unless otherwise indicated.
   2. Use connections that maintain structural value of joined pieces.

B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

F. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Weld exposed corners and seams continuously, unless otherwise indicated.
5. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

H. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

I. Structural performance: Provide assemblies capable of withstanding loadings for treads and platforms for steel stairs with a uniform live load of 100 pounds per square foot on the entire tread and platform area, in accordance with all state and local codes.

J. Priming:

1. Clean surfaces in accordance with Steel Structures Painting Council SP-3, "Power Tool Cleaning;"
2. After surfaces are properly cleaned, apply the primer to a uniform 2.0 mils dry film thickness.

2.9 STEEL-FRAMED STAIRS

A. Stair Framing:

1. Fabricate stringers of steel channels.

    a. Provide closures for exposed ends of channel stringers.
2. Construct platforms of steel channel headers and miscellaneous framing members as needed to comply with performance requirements.
3. Weld stringers to headers; weld framing members to stringers and headers.
4. Where stairs are enclosed by gypsum board assemblies, provide hanger rods or struts to support landings from floor construction above or below. Locate hanger rods and struts where they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.
5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

B. Metal-Pan Stairs: Form risers, sub-tread pans, and sub-platforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.0677 inch.

1. Steel Sheet: Uncoated cold-rolled steel sheet, unless otherwise indicated.
2. Directly weld metal pans to stringers; locate welds on top of sub-treads where they will be concealed by concrete fill. Do not weld risers to stringers.
3. Shape metal pans to include nosing integral with riser.
4. At Contractor's option, provide stair assemblies with metal-pan sub-treads filled with reinforced concrete during fabrication.
5. Provide sub-platforms of configuration indicated or, if not indicated, the same as sub-treads. Weld sub-platforms to platform framing.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine the areas and conditions under which work of this Section will be performed. Correct unsatisfactory conditions prior to proceeding.

B. Site Verification of Conditions: Secure and be responsible for all field measurements required for the proper and accurate fabrication and installation of the items included in this Section. Field alterations permitted only upon specific authorization of the Architect.

3.2 INSTALLATION, GENERAL

A. Coordinate with other trades to assure proper and adequate provision in the work of those trades and for interface with the work of this Section.

B. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

C. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

D. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete, unless otherwise indicated.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.

H. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

I. Fill pans with fine-aggregate concrete fill, screeded and trowelled to required depth to allow for tread finish material and nosing.

3.3 ADJUSTING AND CLEANING

J. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

END OF SECTION 05.5100

SECTION 05.5200 - METAL RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Stainless steel handrails for interior applications.
2. Steel railings for interior applications.
3. Galvanized steel handrails for exterior applications.
4. Aluminum Railings.
5. Wire mesh infill panels for guards.
6. Detailing and engineering metal railings to fulfill performance requirements and to conform to design intent indicated of the Drawings.

B. Related Sections include the following:

1. Division 3 Section “Cast-in-Place Concrete” Construction of interior stairs with metal railings.
2. Division 5 Section “Metal Stairs” Steel-framed stairs for railings
3. Division 9 Section “Painting and Finishing” Field painting shop primed railings
4. Division 9 Section “Epoxy Resin Terrazzo Flooring” Precast Terrazzo treads for metal stairs.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Railing brackets.
2. Grout, anchoring cement, and paint products.
3. Woven-wire mesh metal infill panels.
4. Fasteners

B. Shop Drawings: Show fabrication and installation of handrails and railings. Include plans, elevations, sections, component details, and attachments to other Work.

C. Samples for Initial Selection: For products involving selection of color, texture, or design, including mechanical finishes.

D. Samples for Verification: For each type of exposed finish required.
1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters, including finish.
2. Fittings and brackets.
3. Assembled sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.
    a. Show method of connecting and finishing members at intersections.

E. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

D. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

E. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Storage: Store handrails and railings in a dry, well-ventilated, weathertight place.

C. Field Measurements: Verify handrail and railing dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

D. Coordination: Coordinate installation of anchorages for handrails and railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

E. Scheduling: Schedule installation so handrails and railings are mounted only on completed walls. Do not support temporarily by any means that does not satisfy structural performance requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01.4000 "Quality Requirements," to design railings, including attachment to building construction.

B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.

2. Stainless Steel: 60 percent of minimum yield strength.
3. Steel: 72 percent of minimum yield strength

C. Structural Performance: Provide railings including their attachments to the building capable of withstanding the effects of gravity loads and the following loads and stresses within the limits and under conditions indicated:

1. Handrails and Top Rails of Guards:
   a. Uniform load of 50 lbf/ft. applied in any direction.
   b. Concentrated load of 200 lbf applied in any direction.
   c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:
   a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
   b. Infill load and other loads need not be assumed to act concurrently.

D. Thermal Movements: Provide exterior railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature range: 120 deg F ambient; 180 deg F at material surfaces.

E. Control of Corrosion : Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

2.2 METALS, GENERAL

A. General: Provide metal free from pitting, seam marks, roller marks, stains, discolorations, and other imperfections where exposed to view on finished units.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface

2.3 STEEL RAILINGS

A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

B. Steel Tubing: Cold-formed steel tubing, ASTM A 500, Grade A, unless another grade is required by structural loads.

C. Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

1. Provide galvanized finish for exterior installations and where indicated.

D. Plates, Shapes, and Bars: ASTM A36/A36M.

E. Cast Iron Fittings: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

F. Expanded Metal Infill Panels: ASTM F1267, [Type I (expanded)] [Type II (expanded and flattened)], Class 1 (uncoated).

1. Style Designation: [3/4 number 13] [1-1/2 number 10] <Insert designation>.

G. Perforated-Metal Infill Panels:

1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, or hot-rolled steel sheet, ASTM A1011/A1011M, commercial steel, Type B, [0.060 inch (1.52 mm)] <Insert dimension> thick, [with 1/4-inch (6.4-mm) holes 3/8 inch (9.5 mm) o.c. in staggered rows] <Insert description>.

a. Basis-of-Design Product: Provide product with perforations matching [product indicated on Drawings] <Insert manufacturer's name; product name or designation>.

2. Galvanized-Steel Sheet, ASTM A653/A653M, G90 (Z275) coating, commercial steel Type B, [0.064 inch (1.63 mm)] <Insert dimension> thick, [with 1/4-inch (6.4-mm) holes 3/8 inch (9.5 mm) o.c. in staggered rows] [with 1/8-by-1-inch (3.2-by-25.4-mm) round end slotted holes in staggered rows] <Insert description>.

a. Basis-of-Design Product: Provide product with perforations matching [product indicated on Drawings] <Insert manufacturer's name; product name or designation>.

H. Woven-Wire Mesh Infill Panels: Intermediate-crimp, [diamond] [square] pattern, 2-inch (50-mm) woven-wire mesh, made from 0.134-inch- (3.42-mm-) diameter steel wire complying with ASTM A510 (ASTM A510M).

1. Basis-of-Design Product: Provide product with crimp pattern matching [product indicated on Drawings] <Insert manufacturer's name; product name or designation>.

2.4 ALUMINUM RAILINGS

A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

B. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.

C. Extruded Bars and Tubing: ASTM B221, Alloy 6063-T5/T52.

D. Extruded Structural Pipe and Round Tubing: ASTM B429, Alloy 6063-T6.

1. Provide Standard Weight (Schedule 40) pipe unless otherwise indicated.

E. Drawn Seamless Tubing: ASTM B210, Alloy 6063-T832.

F. Plate and Sheet: ASTM B209, Alloy 6061-T6.

G. Die and Hand Forgings: ASTM B247, Alloy 6061-T6.

H. Castings: ASTM B26/B26M, Alloy A356.0-T6.

I. Perforated Metal Infill Panels: Aluminum sheet, ASTM B209, Alloy 6061-T6, 0.063 inch thick, with 1/4-inch holes 3/8 inch o.c. in staggered rows.

1. Basis-of-Design Product: Provide product with perforations matching [product indicated on Drawings] <Insert manufacturer's name; product name or designation>.

J. Woven-Wire Mesh Infill Panels: Intermediate-crimp, [diamond] [square] pattern, 2-inch (50-mm) woven-wire mesh, made from 0.162-inch- (4.1-mm-) diameter aluminum wire complying with ASTM B211/B211M, Alloy 6061-T94.

1. Basis-of-Design Product: Provide product with crimp pattern matching [product indicated on Drawings] <Insert manufacturer's name; product name or designation>.

2.5 STAINLESS STEEL:

A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

B. Grade or type designated below for each form required:
1. Tubing: ASTM A 554, Grade MT 316L.
2. Castings: ASTM A 743, Grade CF 8M or CF 20M.
3. Plate: ASTM A 666, Type 316L.
4. Woven-Wire Mesh Infill Panels: Intermediate-crimp, square pattern, 1-1/2-inch (38-mm) woven-wire mesh, made from 0.141-inch- (3.57-mm-) diameter stainless steel wire complying with ASTM A580/A580M, Type 304.

2.6 FASTENERS

A. General: Provide the following:
   1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 for zinc coating.
   2. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.
   3. Aluminum Railing Components: Type 304 stainless steel fasteners.
   4. Stainless Steel Railing Components: Type 304 stainless steel fasteners.
   5. Finish exposed fasteners to match appearance, including color and texture, of railings

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads

C. Fasteners for Interconnecting Railing Components:
   1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
   2. Provide square or hex socket flat-head machine screws for exposed fasteners unless otherwise indicated.

2.7 MISCELLANEOUS MATERIALS

A. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

B. Handrail Brackets: Stainless steel units of size or with extenders to provide required clearance between handrail and wall or post and other obstructions; and with exposed square edges machine ground to produce eased edges.

   1. Brackets for Wall-Mounted Handrails: With round flange with tapped hole for concealed mounting.
      a. Product: Julius Blum & Company; Model No. 223.
   2. Brackets for Post-Mounted Handrails: With threaded stud with tapped hole for concealed mounting.
      a. Product: Julius Blum & Company; Model No. 222.

C. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

D. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

F. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

G. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

H. Intermediate Coats and Topcoats: Provide products that comply with Section 09 9100 "Painting." and Section 09 9623 "Graffiti-Resistant Coatings."

I. Epoxy Intermediate Coat: Complying with MPI #77 and compatible with primer and topcoat.

J. Polyurethane Topcoat: Complying with MPI #72 and compatible with undercoat.

K. Bituminous Paint: Cold-applied asphalt emulsion, complying with ASTM D1187/D1187M.

L. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

M. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
   1. Water-Resistant Product: At exterior locations, provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior u

2.8 FABRICATION

A. General: Fabricate handrails and railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble handrails and railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Form changes in direction of members as detailed, or if not detailed, by radius bends, by mitering at elbow bends, or by insertion of prefabricated flush elbow fittings.

D. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

E. Welded Connections: Fabricate handrails and railings for connecting members by welding, unless otherwise indicated. Cope components at perpendicular and skew connections to

provide close fit, or use fittings designed for this purpose. Weld connections continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
5. Welded Joints; All welding shall comply with the National Ornamental and Miscellaneous Metals Association for Finish No. 2.

F. Welded Connections for Aluminum Pipe: Fabricate handrails and railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.

G. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect handrail and railing members to other work, unless otherwise indicated.

H. Provide inserts and other anchorage devices for connecting handrails and railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by handrails and railings. Coordinate anchorage devices with supporting structure.

I. For removable railing posts, fabricate slip-fit sockets from steel tube whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.

1. Provide anchorage to structural steel framing for sockets, designed for setting in metal floor deck with concrete fill.

J. Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.

K. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.

L. Cut, reinforce, drill, and tap components, as indicated, to receive finish hardware, screws, and similar items.

M. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members that are exposed to exterior or to moisture from condensation or other sources.

N. Fabricate joints that will be exposed to weather in a watertight manner.

O. Close exposed ends of handrail and railing members with prefabricated end fittings.

P. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns, unless clearance between end of railing and wall is 1/4 inch or less.

Q. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated

2.9 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Provide exposed fasteners with finish matching appearance of handrails and railings.

2.10 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.

B. Class I, Color Anodic Finish: AA-M21C34A44(204R1) (Mechanical Finish: non-specular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, colored coating 0.7 mil or thicker, complying with AAMA 611.

2.11 STAINLESS-STEEL FINISHES

A. Remove or blend tool and die marks and stretch lines into finish.

B. Grind and polish surfaces to produce uniform, directionally textured polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. Bright, Directional Polish: No. 4 finish.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.12 STEEL FINISHES

A. General: Provide shop-applied finishes for ferrous metal as follows:

1. Interior Railing Assemblies: Shop-primed for field painting, unless otherwise indicated.
2. Exterior Railing Assemblies: Galvanized and shop-primed for field painting.

B. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

C. For galvanized handrails and railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

D. For nongalvanized steel handrails and railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.

E. Preparation for Shop Priming: After galvanizing, thoroughly clean handrails and railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic-phosphate process.

F. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed handrails and railings:

1. Interiors (SSPC Zone 1A): SSPC-SP 7, "Brush-off Blast Cleaning."

G. Apply shop primer to prepared surfaces of handrail and railing components, unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Do not apply primer to galvanized surfaces when galvanized handrails and railings are shop primed.
2. Stripe paint edges, corners, crevices, bolts, and welds.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.
   1. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
   2. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.

B. Perform cutting, drilling, and fitting required to install handrails and railings. Set handrails and railings accurately in location, alignment, and elevation; measured from established lines and levels and free from rack.

   1. Do not weld, cut, or abrade surfaces of handrail and railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
   2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
   3. Align rails so variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Corrosion Protection: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
   1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, or dissimilar metals with a heavy coat of bituminous paint.

D. Adjust handrails and railings before anchoring to ensure matching alignment at abutting joints. Space posts at interval indicated, but not less than that required by structural loads.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing handrails and railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components, unless otherwise indicated. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

3.4 ANCHORING POSTS

A. Use metal sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Leave anchorage joint exposed with anchoring material flush with adjacent surface.

C. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
   1. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

D. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.5 ATTACHING HANDRAILS TO WALLS

A. Anchor railing ends at walls with round flanges anchored to wall construction and welded to railing ends.

B. Attach railings to wall with wall brackets, except where end flanges are used. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

C. Secure wall brackets and railing end flanges to building construction as follows:

   1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
   2. For hollow masonry anchorage, use toggle bolts.
   3. For steel-framed partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.
   4. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.
   5. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.6 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

   1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

3.7 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 05.5200

SECTION 06.1000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Wood grounds, nailers, blocking, and sleepers.
2. Rooftop equipment bases and support curbs.
3. Wood furring and sleepers.
4. Plywood backing panels for mounting electrical and telephone equipment.

B. Related Sections include the following:

1. Division 06 Section "Sheathing": Wall sheathing.
2. Division 07 Section “Composite Metal Panels:
3. Division 07 Section "Fluid-Applied Membrane Air Barriers": Membrane system applied to exterior face of wall sheathing.
4. Section 075300 “Thermoset Single-Ply Roofing” for roofing requirements.
5. Division 09 Section "Gypsum Board Assemblies": Steel framing and gypsum board partitions, for installation of wood blocking required for attachment of wall-mounted items.

1.3 DEFINITIONS

A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise indicated.

B. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

C. Dimension Lumber: Lumber of 2 inches nominal or greater size but less than 5 inches nominal size in least dimension

1.4 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1.5 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Preservative-treated wood.
2. Power-driven fasteners.
3. Powder-actuated fasteners.
4. Expansion anchors.
5. Metal framing anchors.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested

1.7 DELIVERY, STORAGE AND HANDLING

A. Keep materials under cover and dry. Protect from weather and contact with damp or wet surfaces.

B. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Wood-Preservative-Treated Materials:
   a. Hoover Treated Wood Products, Inc
   b. Chemical Specialties, Inc.
   c. Continental Wood Preservers, Inc.
   d. Hickson Corp.
   e. Osmose Wood Preserving, Inc.
2. Metal Framing Anchors:
   a. Alpine Engineered Products, Inc.
   b. Cleveland Steel Specialty Co.
   c. Harlen Metal Products, Inc.
   d. Simpson Strong-Tie Company, Inc.

2.2 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.
1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
4. Provide dressed lumber, S4S, unless otherwise indicated.
5. Provide dry lumber with 15 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.

2.3 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
   1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

D. Application: Treat all miscellaneous carpentry unless otherwise indicated.

2.4 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
   1. Treatment shall not promote corrosion of metal fasteners.
   2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
   3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
   4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D5664, and design value adjustment factors shall be calculated according to ASTM D6841. For enclosed roof framing, framing in attic spaces, and where high-temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat all miscellaneous carpentry unless otherwise indicated.

2.5 MISCELLANEOUS LUMBER

A. General: Provide lumber for support or attachment of other construction.
1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants

B. For items of dimension lumber size, provide Construction, or No. 2 grade lumber with 15 percent maximum moisture content and any of the following species:
1. Mixed southern pine; SPIB.
2. Western woods; WCLIB or WWPA.
3. Hem-fir or Hem-fir (north); NLGA, WCLIB, or WWPA.
4. Eastern softwoods; NeLMA.

C. Concealed Boards: 15 percent maximum moisture content of any of the following species and grades:
1. Mixed southern pine or southern pine, No. 2 grade; SPIB.
2. Eastern softwoods, No. 2 Common grade; NELMA.
3. Northern species, No. 2 Common grade; NLGA.
4. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.6 PANEL PRODUCTS

A. Plywood Backing Panels:

1. For sheet metal closures, provide Exposure 1 sheathing, span rating to suit framing in each location, and thickness as indicated but not less than 1/2 inch.
2. For mounting electrical or telephone equipment, provide fire-retardant-treated plywood panels with grade, C-D Plugged Exposure 1, in thickness indicated or, if not otherwise indicated, not less than 15/32 inch thick.

2.7 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
   1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153.
   2. Where in contact with ACQ preservative-treated wood, provide fasteners of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: CABO NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

F. Lag Bolts: ASME B18.2.1.

G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
   1. Where in contact with ACQ preservative-treated wood, provide stainless steel bolts and washers complying with ASTM A 276 or ASTM A 666, Type 304; and stainless steel nuts complying with ASTM F 594, Alloy Group 1, CW.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit.

Locate nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

C. Do not use materials with defects that impair quality of rough carpentry or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

D. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.

E. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   1. International Building Code; Table 2304.9.1, "Fastening Schedule."
   2. ICC-ES evaluation report for fastener.

F. Use steel common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required. Drive nails snug but do not countersink nail heads unless otherwise indicated.

G. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

H. Do not splice structural members between supports unless otherwise indicated.

I. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
   1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

J. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
   1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
   2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
   3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.

4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.

K. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

L. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

M. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

3.2 INSTALLATION OF WOOD BLOCKING, AND NAILERS

A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build anchor bolts into masonry during installation of masonry work. Where possible, secure anchor bolts to formwork before concrete placement.

3.3 PLYWOOD PANEL INSTALLATION

A. General: Comply with applicable recommendations contained in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.
1. Comply with "Code Plus" provisions in above-referenced guide.

B. Fastening Methods: Fasten panels as indicated below:
1. Plywood Backing Panels: Nail or screw to supports.

3.4 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06.1000

SECTION 06.1600 - SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Roof sheathing.
3. Parapet sheathing.
4. Subflooring.
5. Underlayment

B. Related Requirements:

1. Division 06 "Rough Carpentry" for plywood backing panels.
2. Division 07 "Liquid-Applied Membrane Air Barriers" for air barriers applied to wall sheathing.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review air-barrier and water-resistant glass-mat gypsum sheathing requirements and installation, special details, transitions, mockups, air-leakage testing, protection, and work scheduling that covers air-barrier and water-resistant glass-mat gypsum sheathing

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.

2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5516.
4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. For air-barrier and water-resistant glass-mat gypsum sheathing, include manufacturer's technical data and tested physical and performance properties of products.

B. Shop Drawings: For air-barrier and water-resistant glass-mat gypsum sheathing assemblies.

1. Show locations and extent of sheathing, accessories, and assemblies specific to Project conditions.
2. Include details for sheathing joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
3. Include details of interfaces with other materials that form part of air barrier.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: From air-barrier and water-resistant glass-mat gypsum sheathing manufacturer, certifying compatibility of sheathing accessory materials with Project materials that connect to or that come in contact with the sheathing.

C. Product Test Reports: For each air-barrier and water-resistant glass-mat gypsum sheathing assembly, indicating compliance with specified requirements, for tests performed by a qualified testing agency.

D. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated plywood.
2. Fire-retardant-treated plywood.
3. Foam-plastic sheathing.
4. Air-barrier and water-resistant glass-mat gypsum sheathing.

E. Field quality-control reports

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer of air-barrier and water-resistant glass-mat gypsum sheathing.

1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.

B. Testing Agency Qualifications:

1. For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.
2. For testing and inspecting agency providing tests and inspections related to air-barrier and water-resistant glass-mat gypsum sheathing: an independent agency, qualified according to ASTM E329 for testing indicated, and certified by Air Barrier Association of America, Inc.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on field mockups.

B. Mockup Testing: Air-barrier and water-resistant glass-mat gypsum sheathing assemblies shall comply with performance requirements indicated, as evidenced by reports based on mockup testing by a qualified testing agency.

1. Air-Leakage-Location Testing: Mockups will be tested for evidence of air leakage according to .
2. Air-Leakage-Volume Testing: Mockups will be tested for air-leakage rate according to .
3. Notify Architect days in advance of the dates and times when mockups will be tested.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: As tested according to ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 WOOD PANEL PRODUCTS, GENERAL

A. Emissions: Products shall meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

C. Factory mark panels to indicate compliance with applicable standard.

2.3 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D5516 and design value adjustment factors shall be calculated according to ASTM D6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F shall be not less than span ratings specified.

C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

E. Application: Treat plywood indicated on Drawings, and the following:

1. Roof and wall sheathing within 48 inches of fire walls.
2. Roof sheathing.
3. Subflooring and underlayment for raised platforms.

2.4 WALL SHEATHING

A. Glass-Mat Gypsum Sheathing: ASTM C1177/C1177M.

1. Product: Subject to compliance with requirements, provide products by one of the following:
   a. Dens-Glass Gold by G-P Gypsum Corporation.
   b. SECUROCK Brand Glass Mat Sheathing by United States Gypsum Company.
   c. Weather Defense Platinum by LaFarge North America.
   d. GlasRoc by Certainteed.
2. Type and Thickness: As indicated, but not less than Type X, 5/8 inch thick.
3. Size: 48 by 96 inches for vertical installation.

B. Cementitious Backer Units: ASTM C1325, Type A.

1. Products: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Custom Building Products.
   b. USG Corporation.
2. Thickness: As indicated, but not less than 5/8 inch.

2.5 ROOF SHEATHING

A. Plywood Sheathing: , Exposure 1, Structural I sheathing.

1. Span Rating: Not less than 48/24.
2. Nominal Thickness: Not less than 1/2 inch .
3. Fire retardant treated plywood

2.6 PARAPET SHEATHING

A. Plywood Sheathing: , Exterior, Structural I sheathing.

1. Span Rating: Not less than 48/24.
2. Nominal Thickness: Not less than 1/2 inch .
3. Fire retardant treated plywood

2.7 SUBFLOORING AND UNDERLAYMENT

A. Plywood Combination Subfloor-Underlayment: DOC PS 1, Exposure 1, Structural I, Underlayment single-floor panels.

1. Span Rating: Not less than 48.
2. Nominal Thickness: Not less than 23/32 inch .
3. Edge Detail: Tongue and groove.
4. Surface Finish: Fully sanded face.

B. Underlayment: Provide underlayment in nominal thicknesses indicated or, if not indicated, not less than 1/4 inch over smooth subfloors and not less than 3/8 inch over board or uneven subfloors.

2.8 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For roof, parapet, and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M .

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Screws for Fastening Sheathing to Wood Framing: ASTM C1002.

E. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C 1002.
2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C 954.

2.9 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing Board: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated, and complying with requirements for elastomeric sealants specified in Division 07 Section “Joint Sealants”.

2.10 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.030 inch.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Carlisle Coats & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
   b. Grace Construction Products, a unit of W.R. Grace & Co. – Conn; Vycor V40 Weather Barrier Strips
   c. Polyguard Products, Inc; Polyguard 300

B. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. NES NER-272 for power driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.

D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate wall, parapet, and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast. For composite deck products that are not immediately shingled, provided an underlayment that will prevent moisture penetration into panels.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Combination Subfloor-Underlayment:
    a. Screw to cold-formed metal framing.
    b. Space panels 1/8 inch apart at edges and ends.
2. Subflooring:
    a. Screw to cold-formed metal framing.
    b. Space panels 1/8 inch apart at edges and ends.
3. Wall and Roof Sheathing:
    a. Screw to cold-formed metal framing.
    b. Space panels 1/8 inch apart at edges and ends.
4. Underlayment:
    a. Nail or staple to subflooring.
    b. Space panels 1/32 inch apart at edges and ends.
    c. Fill and sand edge joints of underlayment receiving resilient flooring immediately before installing flooring

3.3 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to cold-formed metal framing with screws.
2. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
3. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent panels without forcing. Abut ends over centers of studs, and stagger end joints of adjacent panels not less than one stud spacing. Attach at perimeter and within field of panel to each stud.

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.
2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed

D. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.
2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

E. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

3.4 CEMENTITIOUS BACKER UNIT INSTALLATION

A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.5 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing where recommended by manufacturer or where indicated to comply with manufacturers' written instructions.

1. Prime substrates as recommended by flashing manufacturer.
2. Laps seams and junctures with other materials at least 4 inches, except that at flashings flanges of other construction, laps need to exceed flange width.

3. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

3.6 FIELD QUALITY CONTROL

A. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program.

B. Testing and Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Inspections: Air-barrier and water-resistant glass-mat gypsum sheathing, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:

1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
2. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
3. Termination mastic has been applied on cut edges.
4. Strips and transition strips have been firmly adhered to substrate.
5. Compatible materials have been used.
6. Transitions at changes in direction and structural support at gaps have been provided.
7. Connections between assemblies (sheathing and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
8. All penetrations have been sealed.

D. Tests: As determined by testing agency from among the following tests:

1. Air-Leakage-Location Testing: Air-barrier sheathing assemblies will be tested for evidence of air leakage according to ASTM E1186, chamber pressurization or depressurization with smoke tracers
2. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate according to ASTM E783 or ASTM E2357.

E. Air barriers will be considered defective if they do not pass tests and inspections.

F. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

G. Prepare test and inspection reports.

END OF SECTION 06.1600

SECTION 06.4023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Interior wood standing and running trim and other woodwork for transparent finish, including:
   a. Built-in wood benches.
   b. Shop finishing of interior woodwork.
   c. Other items as shown on the Drawings.

2. Custom architectural casework not specified in other Sections, fabricated from wood components and plastic laminate, including but not limited to:
   a. Reception desks.
   b. Countertops.

3. Custom recessed display cases with glass doors, glass shelves, and shelf standards.
4. Flush wood veneer panels for wayfinding signage.
5. Wood shelves for closets and janitor closets, with painted finish.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications": Requirements for steel supports for architectural woodwork.
2. Division 06 Section "Rough Carpentry": Furring, blocking, shims, and hanging strips for installing interior woodwork
3. Division 08 Section "Glazing": Requirements for glass and glazing for architectural woodwork.
4. Division 09 Section "Painting": Field finishing of architectural woodwork not indicated for shop finish.
5. Division 12 Section "Manufactured Laminate-Clad Casework": Requirements for factory-manufactured laminate-clad casework not specified in this Section.
6. Division 26 Sections: Electrical work, display case lighting fixtures.

1.2 DEFINITIONS

A. Architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items, unless concealed within other construction before woodwork installation.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, including:
   1. Substrate and core materials.
   2. Wood fiberboard tackboard material.
   3. Laminates and adhesives.
   4. Counter materials.
   5. Cabinet hardware and accessories.
   6. Manufactured coat racks.
   7. Finishing materials and processes.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
   1. Show details full size.
   2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, and other items installed in architectural woodwork.
   4. Show proposed method for fabricating curved veneered panels.
   5. Show coordination with electrical work and video monitors.

C. Samples for Verification: As follows:
   1. Wood-Veneer-Faced Panel Products for Transparent Finish: 8 by 10 inches, finished on one side and one edge.
   2. Lumber for Transparent Finish: 50 sq. inches, finished on 1 side and 1 edge.
   3. Plastic-Laminate-Clad Panel Products: 8 by 10 inches, for each color and pattern.
   4. Counter Material: 6 inches square.
   5. Fabric and core material for tackboard panels.
   6. Exposed Metal: Representative samples of specified metal and finish as requested by Architect.

D. Product Certificates: Signed by manufacturers of woodwork certifying that products furnished comply with requirements.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Installer Qualifications: An experienced installer who has completed architectural woodwork similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of similar projects with a minimum of (5) similar projects in the past 5 years.

C. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with sequence-matched wood veneers.

D. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of architectural woodwork, construction, finishes, and other requirements.

1. The Contract Documents may contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with such selections and requirements in addition to the quality standard.

E. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups of typical architectural wood cabinets and display cases as shown for this Project on Drawings.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial.

G. Pre-installation Conference: Meet at project site prior to delivery of architectural woodwork and review coordination and environmental controls required for proper installation and ambient conditioning in areas to receive work. Include in meeting the Contractor; Architect and other Owner Representatives (if any); Installers of architectural woodwork, wet work such as plastering, other finishes, painting, mechanical work and electrical work; and firms or persons responsible for continued operation (whether temporary or permanent) of HVAC system as required to maintain temperature and humidity conditions. Proceed with woodwork installation only when everyone concerned agrees that required ambient conditions can be maintained.

1.5 DELIVERY, STORAGE AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 percent during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.
2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that architectural woodwork can be supported and installed as indicated.

B. Coordination with Related Items: Coordinate architectural woodwork with sizes, locations and access required for items incorporated into woodwork assemblies, including mechanical and electrical components.

C. Hardware Coordination: Distribute copies of approved hardware schedule specified in Division 08 Section "Door Hardware" (Scheduled by Describing Products) to fabricator of architectural woodwork; coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.1 WOODWORK FABRICATORS

A. Available Fabricators: Subject to compliance with requirements, provide interior architectural woodwork by one of the following:

1. National Woodwork Manufacturing (610-317-6300)
2. American Millwork & Cabinetry, Inc. (610-965-0040)
3. Morris Black & Sons (610-264-2700)
4. K & L Woodworking, Inc. (610-372-0738)
5. Eisenhardt Mills (610-253-2791).

2.2 MATERIALS

A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood for Transparent Finish: Do not use 2 adjacent exposed faces that are noticeably dissimilar in color, grain, figure, or natural character markings.

1. Wood Species and Cut, Typical Locations:
    a. Plain-sliced A1 English Walnut
    b. Plain-sliced A1 Grade White Oak

C. Wood Species for Opaque Finish: Yellow poplar or closed-grain white hardwoods.

D. Wood Products: Comply with the following:

1. Hardboard: AHA A135.4.
2. Medium-Density Fiberboard: ANSI A208.2, Grade MD; Exterior Grade where indicated. Made with binder containing no urea formaldehyde.
3. Particleboard: ANSI A208.1, Grade M-2; M-2-Exterior Glue.
4. Softwood Plywood: DOC PS 1, Exterior.
5. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.
6. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.
    a. Factory mark each piece of lumber with grade stamp of grading agency.
    b. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
    c. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
    d. Provide dressed lumber, S4S, unless otherwise indicated.

e. Provide dry lumber with 15 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.

1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following as indicated in the "Design Selection Summary" on the Drawings:
   a. Arborite; Basis-of-Design
   b. Formica Corporation.
   c. Nevamar Company, LLC; Decorative Products Div.
   d. Wilsonart International; Div. of Premark International, Inc.
   e. Laminart.

2. Adhesive for Bonding Plastic Laminate: Non-urea-formaldehyde contact adhesive in compliance with VOC requirements.
3. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

F. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with material and performance requirements in ANSI Z124.3, for Type 5 or Type 6, without a precoated finish.

G. Quartz Surfacing: MSI Quartz, 2 cm (3/4 inch) thick, color and finish as indicated on the Drawings.

1. Manufacturer: Subject to compliance with requirements, provide quartz surfacing products by one of the following:
   a. Viatera Corporation; Basis of Design.
   b. MSI Surfaces, M S International, Inc.
   c. Wilsonart International; Div. of Premark International, Inc

2. Composition: Engineered stone slab made of natural quartz aggregates, pigments, and polyester resins.
3. Finish: Polished (unless otherwise indicated).
4. Edge Profile: As shown on drawings or per design intent.

H. Clear Tempered Glass: ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality q3; manufactured by horizontal (roller hearth) process, with exposed edges seamed before tempering.

1. Applications: Display case doors and shelves, sliding glass pass windows, and glass panels inset in countertops.

I. Tambour Wood Paneling: Tambour panels, profile, species, and finish as indicated on drawings or schedule.

1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:
   a. Akupanel; Basis-of-Design
      Website: www.acoustical artconcepts.com
   b. Surfacing Solutions, Inc.
      Website: www.surfacingsolutions.com, Inc.
   c. White River Hardwoods; sales@whiteriver.com.
   d. Wood Veneer Hub, support@thewoodveneerhub.com.

2. Core: Flexible cloth-backed or rigid substrate-backed as required.
3. Face: English Walnut (Coordinate w/ Finish Schedule)
4. Dimensions: As indicated on the Drawings.
5. Profile: Select from manufacturer's standard profiles
6. Finish: Factory finished as indicated on the Drawings

J. Stainless Steel:

1. Tubing: ASTM A 554, Grade MT 304.
2. Plate: ASTM A 167, Type 304.
3. Bar Stock: ASTM A 276, Type 304.
4. Finish: AISI No. 4 finish unless otherwise indicated.

K. Aluminum:

1. Extruded Bars and Shapes: ASTM B 221,6063-T6.
2. Extruded Pipe and Tubes: ASTM B 429, 6063-T6.
3. Drawn Seamless Tubes: ASTM B 4836063-T832.
4. Plate and Sheet: ASTM B 2096061-T6.
5. Aluminum Finish: Clear anodized unless otherwise indicated.

2.3 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural woodwork.

B. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.

C. Hinges:
   a. Reveal and Flush Overlay (non-face frame) Cabinetry:

1) Basis-of-Design Product: Grass #3903 Snap-on Hinge. 165º 3-Dimensional.

2. Wire Pulls: Back mounted, 4 inches long, 5/16 inches in diameter.
3. Catches: Magnetic catches, BHMA A156.9, B03141.
4. Shelf Rests: BHMA A156.9, B04013.
5. Drawer Slides: BHMA A156.9, B05091.
   a. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-overtravel-extension type; zinc-plated steel ball-bearing slides, and rated for the following loads:
      1) Box Drawer Slides: 100 lbf.
      2) File Drawer Slides: 200 lbf.
      3) Pencil Drawer Slides: 45 lbf.
      4) Keyboard Slide: 75 lbf.
      5) Trash Bin Slides: 200 lbf.
   b. Basis-of-Design Product: Accuride #3832. For Cabinets with face frame construction, provide face frame conversion kit.

6. Keyboard Trays: Product as indicated on Drawings.
7. Cabinet Door Locks: BHMA A156.11, E07121.
8. Drawer Locks: BHMA A156.11, E07041.
9. Provide locks for cabinet doors and drawers unless otherwise indicated.
10. Grommets for Cable Passage through Countertops: Molded-plastic grommets and matching plastic caps with slot for wire passage.
    a. Product: TG Series; Doug Mockett & Co. Inc.
    b. Size: 2-inch diameter unless otherwise indicated.
    c. Color: As selected by Architect.

D. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Stainless Steel: BHMA 630.

E. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.4 INSTALLATION MATERIALS

A. Furring, Blocking, Shims, Nailers, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

C. Adhesives General: Do not use adhesives that contain urea formaldehyde.

D. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Wood Glues: 30 g/L.
2. Contact Adhesive: 250 g/L.

E. Adhesive for Bonding Plastic Laminate: Non-urea-formaldehyde contact adhesive in compliance with VOC requirements. Unpigmented contact adhesive for through-color laminates.

1. Adhesive for Bonding Edges: Hot-melt adhesive, or adhesive specified above for faces.

2.5 FABRICATION, GENERAL

A. Interior Woodwork Grade: Provide Premium grade interior woodwork complying with the referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

D. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch (19 mm) Thick or Less: 1/16 inch (1.5 mm).
2. Edges of Rails and Similar Members More Than 3/4 Inch (19 mm) Thick: 1/8 inch (3 mm).
3. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch (1.5 mm).

E. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.

2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

F. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.

G. Install glass to comply with applicable requirements in Division 08 Section "Glazing" and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.

2.6 INTERIOR WOOD TRIM AND WOODWORK FOR TRANSPARENT FINISH

A. Interior ornamental work for transparent finish includes **but may not be limited** to, the following:

1. Solid stair treads at Promenade and Community Stair
2. Built in millwork in Day Room, Crew Room , and Community Room
3. Wood on Trophy Display case

B. AWI Grade: Premium.

C. Wood Species and Cut:

1. A1 English Walnut, plain sliced veneer
2. A1 English Walnut, plain sawn trim.
3. A1 White Oak, plain sliced veneer
4. A1 White Oak, plain sawn trim.

D. Flush Wood Plywood Paneling:

1. Quality Standard: Comply with AWI Section 500 requirements for flush wood paneling.
2. Paneling shall be 3/4-in. thick, veneer-core plywood, minimum 9 plies for plywood with exposed edges, graded in accordance with AWI for Grade of Work specified, and type of glue recommended for application.

2.7 WOOD CASEWORK FOR TRANSPARENT FINISH

A. Quality Standard: Comply with AWI Section 400 requirements for CASEWORK.

B. Exposed Wood Surfaces: Comply with the following:

1. Grain Matching: Run and match grain vertically for drawer fronts, doors, and fixed panels, unless otherwise indicated.
2. Matching of Veneer Leaves: Book match.
3. Vertical Matching of Veneer Leaves: End match.
4. Veneer Matching within Panel Face: Balance match.

C. Semi-exposed Surfaces: Thermoset decorative overlay.

D. Finished Ends: Provide finished end panels in wood casework at locations on Drawings designated "F.E."

2.8 TROPHY DISPLAY CASE

A. Fabricate to AWI premium grade construction in conformance with AWI Section 400, CASEWORK.

B. Use softwood for structural framing member's standard sizes, space not over 400 mm (16 inches) on center.

C. Use A1 English Walnut or white oak plain sawn for base trim.

D. Use decorative plastic laminate on exposed surfaces where noted for PLAM including interiors.
1. Refer to drawings for PLAM type.

E. Filler Strips: Provide as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as cabinets.

F. AWI Grade: Premium.

G. Wood Species and Cut:
1. A1 White Oak, plain sliced veneer.
2. A1 White Oak, plain sawn trim.

3. A1 English Walnut, plain sliced veneer.

4. A1 English Walnut, plain sawn trim.

5.

2.9 DISPLAY CASES

A. Quality Standard: Comply with AWI Section 400.

B. Wood Frames and Trim: Solid lumber or veneered construction, as indicated.
   1. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.

C. Glass Doors: Clear tempered glass, 6 mm (1/4 inch) thick, with flat polished edge.
   1. Provide ground finger pulls in glass doors.

D. Glass Shelves: Clear tempered glass, 6 mm (1/4 inch) thick, with flat polished edge.
   1. Provide three full depth glass shelves the full length of each display case, unless otherwise indicated, in sections not less than 24 inches nor more than 36 inches long.

E. Wall Panels and Shelf Standards: Provide complete integrated system of wall furring, extruded vertical standards, shelf brackets, tackable fabric-wrapped panels, panel support clips, top and bottom channels, and end supports and custom fasteners.
   1. Vertical Standard Spacing: 16 inches o.c.
   2. Brackets: Manufacturer's standard, of type to suit type of standards, glass shelves, and conditions of installation. Provide not less than two brackets per shelf.
      a. Product: Paz Systems Inc.; No. 2085 Straightout Faceouts.
      b. Finish: Polished chrome finish.

F. Accessories: Provide the following:
   1. Slides and Locks for Sliding Glass Doors: Aluminum, ASTM B 221, 6063-T6 with clear anodized finish.
      a. Product: Stylmark Track Assembly Model No. 610185, with lock assembly #510808 master keyed to building locks.
   2. Surface Mounted Fluorescent Light Fixtures: Single lamp channel fixtures, white painted steel sheet metal enclosure for surface mounting, length(s) as indicated. Refer to Electrical Plans for fixture type, size and quantities.

2.10 FLUSH WOOD PANELING

A. Quality Standard: Comply with AWI Section 500 requirements for flush wood paneling.

B. Lumber Trim and Edges: Solid wood compatible with grain and color of veneered panels.

C. Exposed Wood Veneers: Comply with the following:
   1. Matching of Adjacent Veneer Leaves: Book match.
   2. Vertical Matching of Adjacent Veneer Leaves: End match.

3. Veneer Matching within Panel Face: Balance match.

D. Hardwood Veneer Plywood Option: At Contractor's option, flush wood paneling may be fabricated with hardwood veneer plywood, using matched sets complying with specified veneer matching and other requirements indicated for wood paneling.

2.11 WOOD SHELVES FOR PAINTED FINISH

A. Shelving: 3/4-inch hardwood plywood shelving with solid-wood exposed edges.
1. Shelf Cleats: 3/4-by-3-1/2-inch boards.
2. Adjustable Shelf Standards and Supports: Satin stainless steel or satin chrome-plated steel; BHMA A156.9, B04071; with shelf rests, B04081.

2.12 PLASTIC-LAMINATE CASEWORK

A. Quality Standard: Comply with AWI Section 400 requirements for laminate cabinets.

B. AWI Type of Cabinet Construction: Flush overlay.

C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
1. Horizontal Surfaces other than Tops: HGS; 0.048 inch minimum thickness.
2. Vertical Surfaces: HGS; 0.048 inch minimum thickness.
3. Edges for Shelves Inside Cabinets: PVC tape, 0.018-inch minimum thickness, matching laminate in color, pattern, and finish.
4. Edges for Shelves Not Inside Cabinets: Laminate, same as specified for exposed surfaces.

D. Exposed Wood: Solid lumber complying with requirements specified for transparent finished hardwood trim.

E. Materials for Semi-exposed Surfaces: Provide surface materials indicated below:
1. Surfaces other than Drawer Bodies: Thermoset decorative overlay.
2. Drawer Sides and Backs: Solid-hardwood lumber.
3. Drawer Bottoms: Solid-hardwood lumber.

F. Colors, Patterns, and Finishes: As indicated in Finish Legend on the Drawings, or if not indicated, as selected by Architect from manufacturer's full range.

G. Finished Ends: Provide finished end panels in plastic-laminate casework at locations on Drawings designated "F.E."

2.13 PLASTIC-LAMINATE COUNTERTOPS

A. Quality Standard: Comply with AWI Section 400 requirements for high-pressure decorative laminate countertops.

B. High-Pressure Decorative Laminate Grade: HGS; 0.048 inch minimum thickness.

C. Colors, Patterns, and Finishes: As indicated in Finish Legend on the Drawings, or if not indicated, as selected by Architect from manufacturer's full range.

D. Edge Treatment: Same as laminate cladding on horizontal surfaces, unless otherwise indicated.
   1. Where indicated, provide solid lumber complying with requirements specified for transparent finished hardwood trim.

E. Core Material: Particleboard or medium-density fiberboard.

F. Core Material at Sinks: Exterior-grade plywood.

2.14 SOLID-SURFACING MATERIAL FOR COUNTERTOPS AND WINDOW STOOLS

A. Quality Standard: Comply with AWI Section 400 requirements for countertops.

B. Solid-Surfacing-Material Thickness: 1/2 inch.

C. Colors, Patterns, and Finishes: As indicated in Finish Legend on the Drawings, or if not indicated, as selected by Architect from manufacturer's full range.

D. Fabricate tops in one piece with shop-applied backsplashes and edges, and with exposed edges built-up to 1-1/2 inches thick, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

E. Fabricate window stools in one piece with exposed surfaces polished and all corners eased or as indicated on the Drawings.

2.15 PLASTIC-LAMINATE SHELVES

A. Quality Standard: Comply with AWI Section 400 requirements for high-pressure decorative laminate countertops.

B. Grade: Custom.

C. High-Pressure Decorative Laminate Grade: HGS; 0.048 inch minimum thickness.

D. Colors, Patterns, and Finishes: As indicated in Finish Legend on the Drawings, or if not indicated, as selected by Architect from manufacturer's full range.

E. Edge Treatment: Same as laminate cladding on horizontal surfaces.

F. Core Material: Particleboard, medium-density fiberboard, or plywood.

2.16 FASTENERS AND ANCHORS

A. Screws: Select material, type, size, and finish required for each use. Comply with FS FF-S-111 for applicable requirements.

1. For metal framing supports, provide screws as recommended by metal framing manufacturer.

B. Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.

C. Anchors: Select material, type, size, and finish required by each substrate for secure anchorage. Provide nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts and anchors, as required, to be set into concrete or masonry work for subsequent woodwork anchorage.

2.17 SHOP FINISHING ARCHITECTURAL WOODWORK

A. Quality Standard: Comply with AWI Section 1500, unless otherwise indicated.
1. Grade: Premium.

B. General: Shop finish casework and panels at fabrication shop as specified in this Section.
1. Refer to Division 09 Section "Painting and Coating" for finishing architectural woodwork not specified for shop finish, including standing and running wood trim.

C. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.

1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Apply three coats to backs and concealed edges and ends of window sills.

D. Transparent Finish: Comply with requirements indicated below for grade, finish system, staining, and sheen, with sheen measured on 60-degree gloss meter per ASTM D 523:
   1. AWI Finish System TR-6: Catalyzed polyurethane.
   2. Staining: Match approved sample for color.
   3. Sheen: Satin, 30-50 gloss units.
   4. Number of Coats: As required by referenced standard unless otherwise indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas before installation.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in Part 2 of this Section for type of woodwork involved.

B. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.

C. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces and repair damaged finish at cuts.

D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

E. Wood Trim and other Woodwork: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 96 inches long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.
   1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base, if finished.
   2. Install wood trim with no more variation from a straight line than 1/8 inch in 96 inches.

F. Flush Wood Paneling: Anchor panels to supporting substrate with panel adhesive and finish screws.

1. Conceal fasteners to greatest practical extent by locating fasteners where they will be covered by trim. Fill fasteners in exposed locations.
2. Install panels with no more than 1/16 inch in 96-inch vertical cup or bow and 1/8 inch in 96-inch horizontal variation from a true plane.

G. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
2. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

H. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
3. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
4. Caulk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."

I. Window Stools: Install without joints, using full-size pieces for each window stool.
1. Install window stools with no more variation from a straight line than 1/8 inch in 96 inches.

J. Complete the finishing work specified in this Section to extent not completed at shop or before installation of woodwork. Fill fastener holes with matching filler where exposed. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats were applied in shop.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06.4023

SECTION 07.1100 - DAMPPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes asphalt dampproofing of the types indicated, applied to surfaces as follows:
   1. Cold-applied, cut-back asphalt dampproofing applied to below-grade surfaces of elevator pits, foundation walls, and site walls.

B. Related Sections include the following:
   1. Division 03 Section "Cast-in-Place Concrete": Concrete placement, curing and finishing.
   2. Division 07 Section "Fluid-Applied Membrane Air Barriers": Air barrier membrane applied to outer face of inner wythe of cavity walls.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include recommendations for method of application, primer, number of coats, coverage or thickness.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain primary dampproofing materials and primers through one source from a single manufacturer. Provide secondary materials recommended by manufacturer of primary materials.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in original, factory-sealed, unopened containers bearing manufacturer's name and label intact and legible with following information.
   1. Name of material.
   2. Manufacturer's stock number and date of manufacture.

B. Store materials in protected and well ventilated area. Handle materials to avoid damage.

1.5 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit asphalt dampproofing to be performed according to manufacturers' written instructions.

B. Coordinate waterproofing work with other trades.

C. Keep flammable products away from spark or flame. Do not allow the use of spark producing equipment during application and until all vapors have dissipated. Post "NO SMOKING" signs.

D. Maintain work area in a neat and orderly condition, removing empty containers, rags, and rubbish daily from the site.

1.6 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.7 WARRANTY

A. Warranty: Provide manufacturer's standard limited material warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. KARNAK Corporation.
   2. BASF Corporation; Construction Systems.
   3. W. R. Meadows, Inc.
   4. Grace Construction Products
   5. Carlise Coatings & Waterproofing, Inc.
   6. Henry Company
   7. Tamko Building Products, Inc.

2.2 MATERIALS FOR FOUNDATION WALLS, ELEVATOR PITS & SITE WALLS

A. Fibered Emulsion Dampproofing: Brush or spray applied, general purpose coating. Manufactured with refined asphalt, clay emulsifiers, and selected non-asbestos fibers.
   1. ASTM D1227, Type II, Class I.
   2. ASTM D1187, Type I and II.
   3. Coverage Rate: 4 to 6 gallons per 100 square feet.
   4. Solids by Weight: 52 percent, nominal.
   5. Solids by Volume: 49 percent, nominal.
   6. Color: Black.
   7. Permeance: 0.5 perms.
   8. Cure Time: 24 to 48 hours at 77 degrees F and 50 percent Relative Humidity.
   9. Service Temperature (Cured Film): -5 to 180 degrees F.

10. Fabric Reinforcing: Karnak #31 Fiber Glass Membrane.

B. Basis of Design: Karnak 220AF Fibered Emulsion Dampproofing.

C. Protection Course, Asphalt-Board Type: Premolded, 1/8-inch-thick, multi-ply, semirigid board consisting of a mineral-stabilized asphalt core sandwiched between layers of asphalt-saturated felt and faced on 1 side with polyethylene film.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Applicator present, for compliance with requirements for surface smoothness and other conditions affecting performance of work.
   1. Begin dampproofing application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protection of Other Work: Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.

B. Clean substrates of projections and substances detrimental to work; fill voids, seal joints, and apply bond breakers if any, as recommended by prime material manufacturer.

3.3 APPLICATION, GENERAL

A. Comply with manufacturer's written recommendations unless more stringent requirements are indicated or required by Project conditions to ensure satisfactory performance of dampproofing.
   1. Apply additional coats if recommended by manufacturer or required to achieve coverages indicated.
   2. Allow each coat of dampproofing to cure 24 hours before applying subsequent coats.

3.4 FOUNDATION WALL, ELEVATOR PIT & SITE WALL DAMPPROOFING

A. Apply dampproofing to elevator pit walls, foundation walls and footings.
   1. Apply from floor line to top of footing, extend over top of footing, and down a minimum of 6 inches over outside face of footing.

2. Extend 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
3. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where shown, by embedding an 8-inch-wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat required for embedding fabric is in addition to other coats required.

B. On Concrete Foundations: Apply two brush or spray coats at not less than 1.25 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat, or one trowel coat at not less than 4 gal./100 sq. ft.

C. On Masonry Walls: Apply primer and two brush or spray coats at not less than 1.25 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat, or primer and one trowel coat at not less than 4 gal./100 sq. ft.

D. Install protection course over completed-and-cured dampproofing. Comply with dampproofing material manufacturer's written recommendations for attaching protection course. Support protection course with spot application of trowel-grade mastic where not otherwise indicated.

3.5 CLEANING

A. Remove dampproofing materials from surfaces not intended to receive dampproofing.

END OF SECTION 07.1100

SECTION 07.1326 - SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Modified bituminous sheet waterproofing.
2. Protection course.
3. Molded-sheet drainage panels.

B. Related Requirements:

1. Section 07.9500 "Expansion Control" for exterior-wall expansion-joint assemblies that interface with waterproofing.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Research Reports: For modified bituminous sheet waterproofing/termite barrier, showing compliance with ICC AC380.

C. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.

1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.8 WARRANTY

A. Manufacturer's Warranty:

1. Waterproofing Warranty: Manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.
   a. Warranty Period: Five years from date of Substantial Completion.

B. Installer's Special Warranty: Specified form, signed by Installer, covering Work of this Section, for warranty period of two years.

1. Warranty includes removing and reinstalling protection board, drainage panels, insulation, pedestals, and pavers on plaza decks.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Waterproofing System: Obtain waterproofing materials, protection course, and molded-sheet drainage panels from single source from single manufacturer.

2.2 MODIFIED BITUMINOUS SHEET WATERPROOFING

A. Modified Bituminous Sheet Waterproofing: Minimum 60-mil nominal thickness, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated on one side to a 4-mil- thick, polyethylene-film reinforcement, and with release liner on adhesive side; formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Sika Corporation
   b. American Hydrotech, Inc.
   c. Carlisle Coatings & Waterproofing Inc.
   d. CETCO, a Minerals Technologies company.
   e. W.R. Meadows, Inc.
   f. York Manufacturing, Inc.

2. Physical Properties:
   a. Tensile Strength, Membrane: 325 psi minimum; ASTM D412, Die C, modified.
   b. Ultimate Elongation: 300 percent minimum; ASTM D412, Die C, modified.
   c. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D1970/D1970M.
   d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C836/C836M.
   e. Puncture Resistance: 50 lbf minimum; ASTM E154/E154M.
   f. Water Absorption: 0.1 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D570.
   g. Water Vapor Permeance: 0.05 perm maximum; ASTM E96/E96M, Water Method.
   h. Hydrostatic-Head Resistance: 231 feet minimum; ASTM D5385.
   i. Reference: SikaShield S-60

2.3 AUXILIARY MATERIALS

A. Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.

   1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.

B. Prefabricated Drainage Mat: Sika® Drainage Mat 420 by Sika Corporation. Drainage composite shall be designed to promote positive drainage while serving as a protection course

C. Primer: Liquid waterborne primer recommended for substrate by sheet waterproofing material manufacturer.

D. Waterstop: Sika Greenstreak waterstops as required by Section 03.3000.

E. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet waterproofing material manufacturer.

F. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity.

G. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating.

H. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch, predrilled at 9-inch centers.

I. Protection Course, Extruded-Polystyrene Board Insulation, Faced: Fan folded, faced on one side with plastic film, nominal thickness 1/4 inch, with compressive strength of not less than 8 psi per ASTM D1621, and maximum water absorption by volume of 0.6 percent per ASTM C272/C272M.

2.4 MOLDED-SHEET DRAINAGE PANELS

A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel with Polymeric Film: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve laminated to one side of the core and a polymeric film bonded to the other side; and with a vertical flow rate through the core of 9 to 21 gpm per ft. .

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Hydrotech, Inc.
   b. Carlisle Coatings & Waterproofing Inc.
   c. CETCO, a Minerals Technologies company.
   d. Sika

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of waterproofing.

1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D4263.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections.

E. Fill form tie holes, honeycomb, aggregate pockets, holes, and other voids.

F. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D4258.

1. Install sheet strips of width according to manufacturer's written instructions and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch .

G. Bridge and cover isolation joints, expansion joints, and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips of widths according to manufacturer's written instructions.

1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.

H. Corners: Prepare, prime, and treat inside and outside corners in accordance with manufacturer's instructions.

1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:
   a. At footing-to-wall intersections, extend liquid membrane in each direction from corner or install membrane strip centered over corner.
   b. At plaza-deck-to-wall intersections, extend liquid membrane or sheet strips onto deck waterproofing and to finished height of sheet flashing.

I. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions.

3.3 INSTALLATION OF MODIFIED BITUMINOUS SHEET WATERPROOFING

A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions.

B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.

C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.

1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.

D. Horizontal Application: Apply sheets from low to high points of decks to ensure that laps shed water.

E. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.

F. Seal edges of sheet waterproofing terminations with mastic.

G. Install sheet waterproofing and auxiliary materials to tie into adjacent waterproofing.

H. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches beyond repaired areas in all directions.

I. Immediately install protection course with butted joints over waterproofing membrane.

1. Molded-sheet drainage panels may be used in place of a separate protection course to vertical applications when approved by waterproofing manufacturer and installed immediately.

3.4 INSTALLATION OF MOLDED-SHEET DRAINAGE PANELS

A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesive or another method that does not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

1. For vertical applications, install board insulation protection course before installing drainage panels.

3.5 PROTECTION, REPAIR, AND CLEANING

A. Do not permit foot or vehicular traffic on unprotected membrane.

B. Protect waterproofing from damage and wear during remainder of construction period.

C. Protect installed insulation drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

D. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

E. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 07.1326

SECTION 07.2100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Perimeter insulation under slabs-on-grade.
2. Perimeter wall insulation (supporting backfill).
3. Concealed building insulation.
4. Spray foam insulation for cavities of exterior walls.
5. Sound attenuation insulation.
6. Closed-cell spray polyurethane foam

B. Related Sections include the following:

1. Division 04 Section "Unit Masonry": Insulation installed in cavity walls.
2. Division 05 Section "Cold-Formed Metal Framing": Metal studs for exterior walls, to receive insulation.
3. Division 06 Section "Sheathing": Nailable composite insulation panels.
4. Division 07 Section "Fluid-Applied Membrane Air Barriers": Air barrier at composite metal panels.
5. Division 09 Section "Gypsum Board Assemblies": Sound attenuation insulation installed as part of metal-framed wall and partition assemblies.

1.3 DEFINITIONS

A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

B. Closed Cell Spray Foam Insulation: Polyurethane spray applied closed-cell foam insulation used as thermal insulation and as an air barrier for exterior cavity walls and foundation walls

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for insulation products.

C. Research/Evaluation Reports: For foam-plastic insulation.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.

B. Spray foam Insulation Installer Qualifications: Engage an experienced dealer/applicator who has been trained and licensed by the product manufacturer, and who has at least three years experience in the installation of product used.

C. Foam Sealant Installer Qualifications: Engage an Installer for infiltration control sealing who has successfully completed 5 installations of scope similar to this Project.

D. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Surface-Burning Characteristics: ASTM E 84.
2. Fire-Resistance Ratings: ASTM E 119.
3. Combustion Characteristics: ASTM E 136.
4. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.

2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.7 PROJECT CONDITIONS

A. Sequencing and scheduling: Inspect for infiltration paths and install expanding foam sealant for infiltration control at the intervals indicated below. Do not enclose building envelope construction before inspecting and sealing infiltration paths.
1. Before installing veneer.
2. Before installing doors and windows.
3. Before installing interior wall finishes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to, manufacturers specified.

2.2 FOAM-PLASTIC BOARD INSULATION

A. Perimeter Insulation: Extruded-Polystyrene Board Insulation: ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, Provide thickness as indicated on the Drawings.

B. Manufacturers:
1. Dow Chemical Company - "Styrofoam Square Edge";
2. Owens Corning – “Foamular NGX CW25.”
3. Kingspan Insulation – North America “Greenguard GG25-LG”

C. Properties:
1. Density: 1 pcf;
2. Minimum compressive strength: 25 psi when tested in accordance with ASTM D 1621;
3. Aged R-value: 5.0 per inch at 75 degrees mean temperature in accordance with ASTM C 518;

2.3 GLASS-FIBER BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. CertainTeed Corporation.
   2. Guardian Fiberglass, Inc.
   3. Johns Manville.
   4. Knauf Fiber Glass.
   5. Owens Corning.

B. Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil-scrim-kraft**,** vapor-retarder membrane on 1 face.

C. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with a minimum thermal resistances indicated:
   1. 2-1/2 inches thick: R-10.9 (Owens Corning CW225);
   2. 3-1/2 inches thick: R-13;
   3. 6-1/4 inches thick: R-19;
   4. 8-1/4 inches thick: R-30;
   5. Other thicknesses as indicated or required.

2.4 CLOSED-CELL SPRAY POLYURETHANE FOAM

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following
   1. Icynene
   2. Johns Manville

B. Closed Cell Spray Polyurethane Foam: Spray Applied Rigid Polyurethane Foam Insulation System: ProSeal LE.
   1. ASTM D 1622, Type II.
   2. Core Density: Minimum Core Density of 2.4 lb/cu. ft.
   3. Aged Thermal Resistance: Minimum aged R-value at 1 inch (25.4-mm) thickness of 7.1 deg
      F x h x sq. ft./Btu at 75 deg F.
   4. Air Permeance: ASTM E 2178, <0.02 L/s m^2 at 1inch.
   5. Water Vapor Permeance: ASTM E 96, 0.97 perm @ 1.5 inch.
   6. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings from an applicable testing agency.
      a. Class 1

b. Flame-Spread Index: 25 or less.
c. Smoke-Developed Index: 300 or less.

C. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.5 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates

B. Locations: As indicated on drawings at typical roof edge details

2.6 SAFING INSULATION

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Fibrex Insulations, Westmont, IL - "FBX Safing Insulation;"
2. Thermafiber LLC, division of United States Gypsum Company, Wabash, IN - "Thermafiber."
3. ROCKWOOL™

B. Asbestos-free, semi-refracting fibers in thicknesses and widths as required with the following attributes:
1. Melting Point: Up to 2,000 degrees F;
2. Non-combustible in accordance with ASTM E 136;
3. Density: 4.0 pcf minimum;
4. Flame Spread/Smoke Density: 5/0 in accordance with ASTM E 84;
5. Moisture Absorption: Less than 1.0 percent per ASTM C 553;

C. Location: mineral wool in each stud cavity at all exterior wall floor line for fire-stopping. Safing thickness must match cavity depth.

2.7 SOUND ATTENUATION INSULATION

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Owens Corning - "Thermafiber SAFB".
2. Rockwool – "AFB"
3. Johns Manville – "Minwool" Sound Attenuation Fire Batt (SAFB)

B. Semi-rigid, 2.5 pcf density, mineral-fiber blanket, thicknesses as required to fill cavity indicated on the Drawings, unfaced.

2.8 AUXILIARY INSULATING MATERIALS

A. Expanding Foam Sealant: Non shrinking, non drying, one-component expanding polyurethane foam sealant suitable for sealing infiltration pathways in building construction; VOC-compliant, with no CFC's or HCFC's; UL Listed, with Flame Spread of 25 or less and Smoke Density of 20 or less.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Dow Chemical Company; Great Stuff Pro.
      b. Geocel Corporation; Expanding Foam Sealant
      c. Macklanburg-Duncan; Polycel Expanding Foam Sealant.
      d. Selena USA Inc., Tytan Products; One-Component Pro, Expanding Polyurethane Gun Foam Sealant.

B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

2.9 INSULATION FASTENERS

A. Products: Subject to compliance with requirements, provide one of the following:
   1. Adhesively Attached, Spindle-Type Anchors:
      a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
      b. Gemco; Spindle Type.
   2. Insulation-Retaining Washers:
      a. AGM Industries, Inc.; RC150.
      b. AGM Industries, Inc.; SC150.
      c. Gemco; Dome-Cap.
      d. Gemco; R-150.
      e. Gemco; S-150.
   3. Anchor Adhesives:
      a. AGM Industries, Inc.; TACTOO Adhesive.
      b. Gemco; Tuff Bond Hanger Adhesive.

B. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:
   1. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   2. Spindle: Copper-coated, low carbon steel, fully annealed, 0.105 inch in diameter, length to suit depth of insulation indicated.

C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.

D. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

E. Steel Sheet Closure and Attachment Components: Metal complying with ASTM C 645 requirements.
   1. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized.
   2. Thickness: Minimum base metal thickness as follows for gages indicated:
      a. 20 gage: 0.0329 inches.
      b. 16 gage: 0.0583 inches.
   3. Break-form to profiles shown.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.

   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

E. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF PERIMETER AND UNDER-SLAB INSULATION

A. On vertical surfaces, insulation units may be dry-laid against foundation as backfilling progresses or set in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.

1. Install insulation board with joints tightly butted.

B. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

3.5 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Seal joints between foam-plastic insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.
1. Tape all joints using insulation manufacturers' recommended foam joint tape.

C. All joints to be sealed using manufacturers recommended foam joint tape.

D. Set vapor-retarder-faced units with vapor retarder to warm-in-winter side of construction, unless otherwise indicated.

1. Tape joints and ruptures in vapor retarder and seal each continuous area of insulation to surrounding construction to ensure airtight installation.

E. Install mineral-fiber insulation in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.

2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Place insulation behind electrical receptacles and piping, with vapor barrier facing to the warm-in-winter side, to form a completely insulated area. Install with tight joints. Cut neatly at all intersections and penetrations.
4. Seal joints on inside face of insulation units with vapor barrier type facing, with self-adhesive vapor barrier tape, and tape over punctures and seal at edges of coverage and at penetrating elements, so as to form a complete vapor barrier for expanse of insulation in each area.
5. Seal joints caused by pipes, conduits, electrical boxes and similar item penetrating vapor retarders with cloth or aluminized tape of type recommended by vapor retarder manufacturer to create an air-tight seal between penetrating objects and vapor retarder.
6. Repair any tears or punctures in vapor barrier immediately before concealment by other work. Cover with tape or another layer of vapor retarder.
7. Maintain 3-inch clearance of insulation around recessed lighting fixtures.
8. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

3.6 INSTALLATION OF SPRAY FOAM INSULATION

A. Spray-Applied Insulation: Apply spray-applied insulation according to manufacturer's written instructions. Do not apply insulation until installation of stud reinforcing, pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.

3.7 INSTALLATION OF INFILTRATION CONTROL SEALANT

A. General: Install expanding foam sealant at all infiltration pathways not blocked by other construction. Install at locations including, but not limited to, door frames, plumbing penetrations, tops and bottoms of frame walls, tops of masonry partitions, at flutes of steel decking, at steel beam cantilevers, wiring penetrations, and similar conditions.
   1. Prepare and install materials according to manufacturer's recommendations.
   2. Do not use expanding foam sealant for conditions where firestopping is indicated or required.

3.8 SOUND ATTENUATION INSULATION

A. Install sound control batt insulation in stud cavities extending up to underside of floor or roof deck above. Friction-fit between metal studs, behind electrical receptacles and piping. Install with tight joints. Cut neatly at all joints and intersections and as required for stud spacings.

B. Provide sound attenuation batts where indicated on the Drawings and around the following areas:
   1. Offices;
   2. Classrooms;
   3. Specialty Rooms;
   4. Health Suite;
   5. Toilet Rooms;
   6. All other occupied spaces not specifically identified.

3.9 PROTECTION AND CLEANING

A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

3.10 FIELD QUALITY CONTROL

A. Field Inspection for Foamed-in-Place Insulation: Break exterior face shells out of concrete masonry units at locations as directed by Architect, but not less than one location for each 50 sq. feet of wall with foamed insulation.
   1. Provide access for observation by Architect.
   2. Where inspection reveals inadequately filled masonry cells, drill additional holes and repeat application procedure.
   3. Patch inspection holes so that no evidence of inspection procedures is visible in the completed work.
   4. Perform additional inspections when results indicate requirements have not been met, as directed by Architect, without cost to Owner.

END OF SECTION 07.2100

SECTION 07.2616 - UNDER-SLAB VAPOR BARRIER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Products Supplied Under This Section

1. Vapor Barrier, seam tape, mastic, pipe boots, detail strip for installation under concrete slabs.

B. Related Sections include the following:

1. Division 01 Section “Construction Waste Management”

2. Division 03 Cast-in-Place Concrete.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. ASTM E 1745-97 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

2. ASTM E 96-95 Standard Test Methods for Water Vapor Transmission of Materials.

3. ASTM E 1643-18a-09 Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

B. Technical Reference: American Concrete Institute (ACI):

1. ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

2. ACI 302.1R-15 Guide to Concrete Floor and Slab Construction.

1.4 SUBMITTALS

A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of vapor barrier.

B. Product Certificates: For vapor barriers, certifying compatibility of vapor barrier and accessory materials with Project materials that connect to or that come in contact with the barrier; signed by product manufacturer.

C. Qualification Data: For Applicator.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for vapor barriers.

E. Quality Control / Assurance

1. Independent laboratory test results showing compliance with ASTM & ACI Standards.

2. Manufacturer’s samples, literature.

3. Manufacturer’s installation instructions for placement, seaming and pipe boot installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufacturers

1. Stego Industries (Basis of Design).
2. W.R.Meadows.
3. Alumiseal.

B. Vapor Barrier

1. Vapor Barrier membrane shall have the following properties.
   a. Minimum 15-mil thick Polyolefin Geomembrane.
   b. Manufactured from Prime, Virgin Resins.
   c. Water Vapor Barrier: ASTM E 1745, Meets or exceeds Class A.
   d. Water Vapor Transmission Rate: ASTM E 96, 0.008 gr./ft^2/hr. or lower.
   e. Permeance Rating: less than 0.01 perms (grain/ft^2/hr/in-Hg) as tested after mandatory conditioning (ASTM E 1745 paragraphs 7.1.2-5).
   f. Puncture Resistance: ASTM D 1709, Minimum 2,400 grams.
   g. Tensile Strength ASTM D 882 Minimum 45.0 lbf./in.

2.2 ACCESSORIES

A. Seams:
1. Stego Tape by Stego Industries LLC.

B. Sealing Penetrations of Vapor barrier:
1. Stego Mastic by Stego Industries LLC.
2. Stego Tape by Stego Industries LLC.

C. Perimeter/edge seal:
1. Stego Crete Claw by Stego Industries LLC.
2. Stego Term Bar by Stego Industries LLC.
3. StegoTack Tape (double-sided sealant tape) by Stego Industries LLC

D. Penetration Prevention:
1. Beast Foot by Stego Industries LLC.
2. Beast Form Stake by Stego Industries LLC.

E. Vapor Barrier-Safe Screed System
1. Beast Screed by Stego Industries, LLC.
2. Beast Hook by Stego Industries, LLC.

F. Pipe Boots
1. Construct pipe boots from vapor barrier material, pressure sensitive tape and/or mastic per manufacturer's instructions.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ensure that subsoil is approved by Architect or Geotechnical Engineer.

1. Level and tamp or roll aggregate, sand or tamped earth base.

3.2 INSTALLATION

A. Install Vapor Barrier/Retarder:

1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.

2. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the structural engineer or (b) where obstructed by impediments, such as dowels, waterstops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself.
   a. Seal vapor barrier to the entire slab perimeter using Stego Crete Claw, per manufacturer's instructions.
      Or
   b. Seal vapor barrier to the entire slab perimeter using Stego Crete Claw, per manufacturer's instructions.

3. Overlap joints 6 inches and seal with manufacturer’s seam tape.

4. Apply seam tape/Crete Claw to a clean and dry vapor barrier.

5. Seal all penetrations (including pipes) per manufacturer’s instructions.

6. For interior forming applications, avoid the use of non-permanent stakes driven through vapor barrier. Use Beast Form Stake and Beast Foot as a vapor barrier-safe forming system. Ensure Beast Foot’s peel-and-stick adhesive base is fully adhered to the vapor barrier.

7. If non-permanent stakes must be driven through vapor retarder, repair as recommended by vapor retarder manufacturer.

8. Use reinforcing bar supports with base sections that eliminate or minimize the potential for puncture of the vapor barrier.

9. Repair damaged areas with vapor barrier material of similar (or better) permeance, puncture and tensile.

10. For vapor barrier-safe concrete screeding applications, install Beast Screed (vapor barrier-safe screed system) per manufacturer’s instructions prior to placing concrete.

END OF SECTION 07.2616

SECTION 07.2726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Surface preparation.

B. Application of liquid-applied vapor permeable air barrier.

C. Application of materials to provide bridge and seal air leakage pathways in
1. Wall and roof connections and penetrations.
2. Connections to foundation walls.
3. Walls, windows, curtain walls, storefronts, louvers, or doors
4. Expansion and control joints.
5. Masonry ties.
6. All other penetrations through the wall assembly.

1.2 RELATED SECTIONS

A. Division 04 - Unit Masonry

B. Division 07 - Thermal Insulation

C. Division 07 - Flashing and Sheet Metal Trim

D. Division 07 - Roof Accessories

E. Division 07 - Joint Sealants

F. Division 08 – Hollow Metal Doors and Frames

G. Division 08 – Aluminum Framed Entrances and Storefronts

H. Division 08 – Glazed Aluminum Curtain walls

1.3 DEFINITIONS

A. Air Barrier Assembly: The collection of air barrier materials and auxiliary materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.4 REFERENCES

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

C. ASTM E96 (Method B) - Standard Test Methods for Water Vapor Transmission of Materials.

D. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

E. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.

F. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference.

G. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials.

H. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.

1.5 PERFORMANCE REQUIREMENTS

A. General: Air barrier shall be capable of performing as a continuous vapor permeable air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

1.6 SUBMITTALS

A. Comply with Section 01.3300 - Submittal Procedures.

B. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of air barrier.

C. Submit manufacturer's product data and application instructions.

D. Product Certificates: For air barriers, certifying compatibility of air barrier and accessory materials with Project materials that connect to or that come in contact with the barrier; signed by product manufacturer.

E. Qualification Data: For Applicator.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for air barriers

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Use an experienced installer and adequate number of skilled personnel who are thoroughly trained and experienced in the application of the air barrier.
   a. Air Barrier Installer performing Work shall be approved by air barrier membrane manufacturer.

B. Obtain air barrier materials from a single manufacturer regularly engaged in manufacturing the product.

C. Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOCs).

1.8 PRECONSTRUCTION MEETING

A. Preconstruction Meeting: Convene one (1) week prior to commencing Work of this section, in accordance with Division 1 Section Project Management and Coordination.
   1. Include installers of other construction connecting to air barrier, including roofing, waterproofing, architectural precast concrete, masonry, sealants, windows, glazed curtain walls, and door frames.
   2. Review air barrier requirements including surface preparation, substrate condition and pretreatment, minimum substrate curing period, forecasted weather conditions, special details and sheet flashings, mockups, installation procedures, sequence of installation, testing and inspecting procedures, and protection and repairs.

1.9 MOCK-UPS

A. Prior to installation of air barrier, apply air barrier as follows to verify details under shop drawing submittals and to demonstrate tie-ins with adjoining construction, and other termination conditions, as well as qualities of materials and execution.

B. Apply air barrier in field-constructed mock-ups of assemblies specified in Section 04 20 00 – Unit Masonry and Section 09 29 00 – Gypsum Board.

C. Apply air barrier in field-constructed mock-ups as directed by architect.

D. Construct typical exterior wall panel, 8' (2.4 m) long by 8' (2.4 m) wide, incorporating back-up wall, cladding, window and doorframe and sill, insulation, flashing, [building corner condition,] [junction with roof system] [foundation wall] [and] [typical penetrations and gaps]; illustrating materials interface and seals.

E. Test mock-up in accordance with in accordance with ASTM E783 and ASTM E1105 for air and water infiltration.

F. Cooperate and coordinate with the Owner's inspection and testing agency. Do not cover any installed air barrier membrane unless it has been inspected, tested, and approved.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the site in their original undamaged packages with labels clearly identifying the product name and manufacturer. Store materials in a clean, dry, protected location and within temperature range required by air barrier manufacturer.

B. Remove and replace liquid materials that cannot be applied within their stated shelf life.

C. Store materials in a clean dry area in accordance with manufacturer's instructions.

D. Store at temperatures at or above 40° F (4° C), free from contact with cold or frozen surfaces.

E. Protect materials during handling and application to prevent damage or contamination.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Product not intended for uses subject to abuse or permanent exposure to the elements.

B. Do not proceed with product application if rainfall is forecast or imminent within 12 hours.

C. Do not apply membrane when air or surface temperatures are below 20° F (-6.7° C).

D. Do not apply when air, material and surface temperatures are expected to fall below 20° F (-6.7° C) within 24 hours of completed application.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. W. R. MEADOWS, INC.
2. Prosoco
3. BASF Wall Systems

4. Dupont Tyvek
5. Sika

2.2 MATERIALS

A. Liquid Air Barrier System: One component, polymer modified, cold applied liquid vapor permeable air barrier membrane.
   1. Performance Based Specification: Air barrier membrane shall be water-based, that cures to form a tough, seamless, elastomeric membrane having the following characteristics:
      a. Air Leakage ASTM E2357: < 0.04 cfm / ft.^{2} @ 75 Pa (1.57 lb./ft.^{2}).
      b. Air Permeability ASTM E2178: < 0.004 cfm/ft.^{2} @ 75 Pa (1.57 lb./ft.^{2}).
      c. Water Vapor Permeance ASTM E96 Method B: > 10 perms.
      d. Elongation ASTM D412: 1300%.
      e. Flexibility at -20° C ASTM C836 2" mandrel: Pass.
      f. Flame Spread and Smoke Development, ASTM E84: Class A.

   2. Basis of Design Specification: AIR-SHIELD LMP by W. R. MEADOWS.

2.3 ACCESSORIES

A. Flashing and Transition Membrane: Self-adhesive polymeric sheet membrane having a thickness of 40 mils (1 mm).
   1. AIR-SHIELD THRU-WALL FLASHING by W. R. MEADOWS.

B. Joint Sealant: Single component, polyurethane joint sealant for exterior sheathing panels.
   1. POURTHANE® NS by W. R. MEADOWS.

C. Liquid Flashing: Fluid applied, single component, flashing membrane for rough openings and detailing.
   1. AIR-SHIELD LIQUID FLASHING by W. R. MEADOWS.

D. Joint Tape: Self-adhesive polymeric membrane for joints of plywood and oriented strand board (OSB).
   1. AIR-SHIELD by W. R. MEADOWS.

E. Membrane Adhesive:
   1. Temperatures above 40° F (4° C): Water-Based Adhesive
      a. MEL-PRIME™ W/B Water-Based Adhesive by W. R. MEADOWS.
   2. Temperatures below 30° F (-1° C): Solvent-Based Primer.
      a. MEL-PRIME VOC Compliant Solvent-Base Adhesive or Standard Solvent-Base Adhesive by W. R. MEADOWS.

F. Pointing Mastic: mastic for sealing penetrations and terminations of membrane.
   1. POINTING MASTIC by W. R. MEADOWS.

G. Detailing Membrane: non-slump waterproofing material for joint detailing.
   1. BEM by W. R. MEADOWS.

H. Concrete Repair Materials: general purpose patching materials.
1. MEADOW-PATCH™ 5 and MEADOW-PATCH 20 Concrete Repair Mortars by W. R. MEADOWS.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements and other conditions affecting performance.
1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
2. Verify that concrete has cured and aged for minimum time period recommended by air barrier manufacturer.
3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
4. Verify that masonry joints are flush and completely filled with mortar.
5. Verify that masonry veneer anchor installation is complete and all blocking is in place.
6. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Protect adjacent surfaces not designated to receive air barrier.

B. Clean and prepare surfaces to receive air barrier membrane in accordance with manufacturer's instructions.

C. Do not apply membrane to surfaces unacceptable to manufacturer.

D. Concrete surfaces must be clean, free of standing water, ice, snow, frost, dust, dirt, oil, curing compounds, or any other foreign material that could prevent proper adhesion of the membrane.

E. Patch all holes and voids and smooth out any surface misalignments.

F. Patch all cracks, protrusions, small voids, offsets, details, irregularities, and small deformities with cementitious patching mortar at least two hours before application.

G. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate patching membrane

G. Ensure joints between dissimilar building materials are sealed with a strip of self-adhesive membrane 6" (150 mm) wide, centered over the joint.

H. Exterior Sheathing Panels:
1. Install and fasten exterior sheathing panels according to the sheathing manufacturer’s instructions.

2. Treat all countersunk and removed fasteners with joint filler or liquid flashing material.
3. Inspect the joint to ensure that all areas to receive joint treatment are clean, dry, smooth, and free from all bond-breaking contaminants.
4. Remove and replace any damaged structural wall components.
5. Joint Treatment with fluid applied membrane
   a. Fill joint area with fluid applied membrane using a spreader tool or putty knife.
   b. Apply fluid applied membrane extending beyond the joint line 3" (76.2 mm) onto face of exterior sheathing.
   c. Fully embed the reinforcing fabric 3" (76.2 mm) wide into the wet fluid applied membrane centered over the joint.
   d. Run the spreader tool or putty knife over the embedded reinforcing fabric to remove any air bubbles.

I Plywood and Oriented Strand Board (OSB):
1. Install and fasten boards according to board manufacturer.
2. Apply membrane adhesive on either side of the joint extending 3" (76.2 mm) from the center.
3. Install a 4" (25.4 mm) strip of self-adhesive membrane centered over the joint and roll press firmly into place.
4. For joints width more than ¼" (6.4 mm), fill with detailing membrane prior to application of self-adhesive membrane.

3.3 APPLICATION OF AIR BARRIER SYSTEM

A. Transition Membrane

1. Prime surfaces to be covered in one working day with applicable primer.
2. Apply transition membrane with a minimum overlap of 3" (75 mm) onto primed surface at all joints, columns, beams, and dissimilar materials.
3. Roll membrane firmly into place.
4. Ensure membrane is fully adhered and remove all wrinkles and fish mouths.
5. Overlap subsequent courses of membrane a minimum of 2" (50 mm) and ensure joints are fully adhered.
6. Seal top edge of transition membrane with pointing mastic.

B. Rough Opening Transition Membrane

1. Self-adhesive Transition Membrane.
   a. Prime the area to be detailed using adhesive recommended by the membrane manufacturer according to the substrate.
   b. Pre-cut the self-adhesive membrane for each area of the rough opening to ensure ease of handling.
   c. Apply the first pre-cut strip at the base of the rough opening by removing the release paper and rolling firmly into place, ensuring that there is a minimum of 3" (75 mm) of membrane extending onto the wall and a minimum of 3" (75 mm) of membrane extending into the rough opening.

d. Repeat this procedure for the vertical areas of the rough opening and the header portion of the opening.
e. Ensure all edge overlaps are a minimum of 2” (50 mm) and end to end overlaps are 4” (100 mm).
f. Seal all terminations with mastic recommended by membrane manufacturer.

C. Through Wall Flashing

1. Prime surfaces to be covered in one working day with applicable adhesive.
2. Remove release paper prior to application.
3. Apply though wall flashing at based of masonry walls as indicated on drawings.
4. Recess through wall flashing 1/2” (13 mm) from the face of the masonry.
5. Apply a bead of pointing mastic if through wall flashing is not embedded into masonry.

D. Air Barrier Membrane

1. Apply air barrier membrane in accordance with manufacturer's instructions.
2. Thoroughly mechanically mix membrane prior to application.
3. Apply membrane by spray or roller at a minimum coverage rate of 25 $ft.^2$/U.S. gal (0.61 m^2/L) providing a thickness of 60 wet mils in two coats.
4. Frequently inspect surface area with a wet mil gauge to ensure consistent thickness.
5. Work material into any fluted rib forming indentations.
6. Cured thickness of membrane should be 30 mils dry.
7. Allow 48 hours for full cure of the membrane.

3. 4 PROTECTION

A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air barrier exposed for more than 30 days.
2. Protect air barrier from contact with creosote, uncured coal-tar products, TPO, EPDM, flexible PVC membranes, and sealants not approved by air barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION 072726

SECTION 07.4213 – FORMED METAL WALL PANELS – MP-02

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Manufactured metal panels for exterior wall panels and sub-girt framing assembly, with related flashings and accessory components.

1.3 RELATED REQUIREMENTS:

1. Division 05 Section "Structural Steel" for structural-steel framing.

2. Division 05 Section "Cold-Formed Metal Framing" for metal studs, bracing, anchorage, and framing accessories.

3. Division 06 Section "Rough Carpentry" for wood framing.

4. Division 07 Section "Sheet Metal Flashing and Trim" for metal flashing and trim not part of this Work.

5. Division 07 Section "Joint Sealants" for field-applied sealants.

1.4 REFERENCE STANDARDS

1. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a

2. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document).

3. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

4. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

5. FL 35063.5 - Florida Product Approval

6. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

7. AAMA 612 - Voluntary Specification, Performance requirements and Test procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum.

1.5 PERFORMANCE REQUIREMENTS

A. General: Provide manufactured wall panel assemblies complying with performance requirements indicated and capable of withstanding structural movement, thermally induced movement, and exposure to weather without failure or infiltration of water into the building interior.

B. Air Infiltration: Provide manufactured wall panel assemblies with permanent resistance to air leakage through assembly of not more than 0.09 cfm/sq. ft. (0.45 L/s/sq. m) of fixed wall area when tested according to ASTM E 283 at a static-air-pressure difference of 4.0 lbf/sq. ft. (192 Pa).

C. Water Penetration: Provide manufactured wall panel assemblies with no water penetration as defined in the test method when tested according to ASTM E 331 at a minimum differential pressure of 20 percent of inward acting, wind-load design pressure of not less than 6.24 lb/sq. ft. (300 Pa) and not more than 12.0 lb/sq. ft. (575 Pa).

D. Structural Performance: Provide manufactured wall panel assemblies capable of withstanding design wind loads indicated under in-service conditions with deflection no greater than the following, based on testing manufacturer's standard units according to ASTM E 330 by a qualified independent testing and inspecting agency.

1. Maximum Deflection: 1/180 of the span.

2. Maximum Deflection: 1/140 of the span.

1.6 SUBMITTALS

A. Product Data: Include manufacturer's product specifications, standard details, certified product test results, and general recommendations, as applicable to materials and finishes for each component and for total panel assemblies.

B. Shop Drawings: Show layouts of panels, details of corner conditions, joints, panel profiles,

supports, anchorages, trim, flashings, closures, and special details. Distinguish between factory-and field-assembled work.

1. For installed products indicated to comply with certain design loadings, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Initial Selection: Manufacturer's color charts or chips showing the full range of colors, textures, and patterns available for wall panels with factory-applied finishes.

D. Mock-Up: Construct mock-up, 8 feet (2.45 m) long by 6 feet (1.83 m) wide; include panel and soffit system, attachments to building frame, associated vapor retarder and air seal materials, weep drainage system, sealants and seals, related insulation in mock-up.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years of documented experience.

1. Manufacturer to be ISO 9001:2015 with design.

B. Installer Qualifications: Engage an experienced installer who has completed metal wall panel projects similar in material, design, and extent to that indicated for this Project and with a record of three years documented experience with this system.

C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where the Project is located and who is experienced in providing engineering services of the kind indicated.

D. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated without delaying the Work, as documented according to ASTM E 699.

E. Source Limitation: Obtain all components of the wall system from or approved by wall panel manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver panels and other components so they will not be damaged or deformed. Package panels for protection against damage during transportation or handling.

B. Handling: Exercise care in unloading, storing, and erecting wall panels to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, off the ground, covered with tarpaulins or other suitable weathertight and ventilated covering. Prevent twisting, bending, or abrasion of the material and finishes. Store panels to ensure dryness. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

1.9 PROJECT CONDITIONS

A. Field Measurements: Verify location of structural members and openings in substrates by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, either establish opening dimensions and proceed with fabricating wall panels without field measurements or allow for trimming panel units. Coordinate wall construction to ensure actual locations of structural members and to ensure opening dimensions correspond to established dimensions.

1.10 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Finish Warranty: Submit a written warranty, signed by manufacturer, covering failure of the factory-applied exterior finish on metal wall panels within the specified warranty period and agreeing to repair finish or replace wall panels that show evidence of finish deterioration. Deterioration of finish includes, but is not limited to, color fade, chalking, cracking, peeling, and loss of film integrity.

C. Finish Warranty Period: 30 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering metal panels that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide panels by one of the following:

1. Aluminum Wall Panels:
   a. ATAS, Basis of Design
      1) Rigid Wall II (MFN160) manufactured by ATAS International, Inc. with concealed fasteners.
   b. Alternate manufacturer's subject to compliance with these specifications:
      1) AEP-Span.
      2) Berridge Manufacturing Co.
      3) Metal Sales Mfg. Corp.

2.2 MANUFACTURED METAL PANELS

A. Wall Panel System: Factory fabricated prefinished metal panel system; site assembled.

1. Provide exterior wall panels.

2. Design and size components to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.

3. Design Pressure: In accordance with applicable codes and as indicated on the Drawings.

4. Maximum Allowable Deflection of Panel: L/180 for length(L) of span.

5. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.

6. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.

7. Panels to be tension leveled during the roll forming process.

8. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.

B. Exterior Wall Panels: Fabricate panel face sheets to the profile or configuration indicated; and of the material, finish, and thickness indicated. Design joints between panels to form weathertight seals.

1. Material: Precoated aluminum sheet, 16 gauge, 0.0508 inch (1.29 mm) minimum thickness.
2. Profile: Rigid Wall II (MFN160); 16” wide ribbed panel with the Wind-Lok interlock,
3. Horizontal Orientation,
4. Side Seams: Continuous interlock, concealing all raw edges,
5. Panel Width: 16” (406 mm).
6. Panel Depth: 15/16” (24 mm).
7. Texture: Smooth.
8. Color: Custom color to be chosen later by Architect from ATAS International.
9. Brake-formed panels will not be accepted.

2.3 MATERIALS

A. Precoated Aluminum Sheet: ASTM B209 (ASTM B209M), 3105 alloy, O temper, smooth surface texture; continuous-coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.

B. Select materials with surface flatness, smoothness, and lack of surface blemishes where exposed to view in finished system.

2.4 FINISHES

A. PVDF Finish Colors:

1. Cleaning and Pretreatment using Wet chemistry technology:
   a. Complex Chrome oxide pretreatment
   b. Chrome final rinse
2. Panel Backside Finish: Panel manufacturer's standard siliconized polyester wash coat.

3. Fluoropolymer Coil Coating System: Manufacturer's standard multi-coat aluminum coil coating system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF) resin, and at least 80 percent of coil coated aluminum surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch (0.023 mm); color and gloss to match sample.
4. Color: Custom color to be chosen later.

2.5 MISCELLANEOUS MATERIALS

A. Cladding Support Clips: Thermally broken, galvanized steel clips for support of cladding z-girts, angles, channels and other framing.

B. Sheathing Ventilation Shims: ASV Spacer Shims - Polyoxymethylene (engineered thermoplastic) ⅜" stackable shims.

C. Miscellaneous Sheet Metal Items: Provide factory formed flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, and equipment curbs of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.

1. Fabricate trim and flashing components in minimum 12'-0" lengths, or as dictated by project conditions and approved by panel manufacturer.

D. Gaskets:

2. Manufacturer's standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant.
3. Profiled Rib Closures: Provide prefabricated, factory pre-notched closures to match the panel profile close fitting components .032 Aluminum in the same color and finish as the wall panel system.

E. Sealants:

4. Exposed Sealant: High Performance Elastomeric; clear tri-polymer, as recommended by manufacturer.
5. Concealed Sealant: High Performance Space Cubes to prevent bottoming out of sealant when fasteners are installed non-curing butyl tape.

6. Seam Sealant: Factory Applied High Performance, high solid, non-skinning, non-drying formulated for roll forming application into concealed panel joints.

F. Fasteners: Provide as recommended by panel manufacturer suitable for application meeting the following characteristics.

7. Self-tapping and Self-drilling for metal to metal
8. Self-tapping wood screws for metal to wood applications
9. Carbon steel thread with organic long-life coating.
10. Exposed fasteners type 304 stainless steel cap head;
    a. Encapsulated EPDM washer
    b. Baked on High performance compatible, chip resistant finish to match panel color.

G. Field Touch up Paint; As recommended by manufacturer

H. Sub-girt Framing Assembly:
18 gauge, 0.040 inch (1.024 mm) thick formed non-precoated steel sheet.
Secondary panel support framing spaced per design pressures indicated by ASCE-7
Profile as indicated; to attach panel system to building.

I. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut, and factory mitered to required angles.

J. Hairline Corner: Provide field-fabricated corners using outside hairline corner trim to maintain continuity of profile around corner allowing for the continuous appearance in a horizontal application wall panels. (Horizontal profile only)

K. Mitered Corner: Provide factory-fabricated mitered internal corners in panel width back braced with 20 gauge, 0.0320 inch (.81 mm) thick perforated aluminum sheet to maintain continuity of profile around corner. Horizontal profile only

L. Extrusions: custom-designed 10-0”aluminum alloy 6063 extrusions factory post-painted in PVDF finish to match wall panels at areas of panel termination as shown on drawings.

M. Expansion Joints: Same material, thickness and finish as exterior sheets; ___ gauge, ___ inch (___ mm) thick; manufacturer's standard brake formed type of design to suit system.

N. Snap J: Factory formed two-piece J-channel to be used in trim areas without clip securement to minimize exposed fasteners

O. Penetration Covers (Z Boxes) to be supplied by panel manufacturer, factory fabricated in same gauge and finish as metal panels.

2.6 FABRICATION

A. General: Fabricate and finish panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Apply bituminous coating or other permanent separation materials on concealed panel surfaces where panels would otherwise be in direct contact with substrate materials that are noncompatible or could result in corrosion or deterioration of either materials or finishes.

C. Fabricate panel joints with captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will minimize noise from movements within panel assembly.

2.7 SECONDARY FRAMING

A. Panel Supports and Anchorage: Provide girts, furring channels, angles, plates, bracing, and other secondary framing members.

1. Girts: C- or Z-shaped sections fabricated from 0.0598-inch- (1.5-mm-) thick, shop-painted, roll-formed steel.

2. Flange and Sag Bracing: 1-5/8-by-1-5/8-inch (41-by-41-mm) angles, fabricated from 0.0598-inch- (1.5-mm-) thick, shop-painted, roll-formed steel.

3. Base or Sill Angles: Fabricate from 0.079-inch- (2.0-mm-) thick, cold-formed, galvanized steel sections.

4. Secondary structural members, except columns and beams, shall be manufacturer's standard sections fabricated from 0.079-inch- (2.0-mm-) thick, cold-formed galvanized steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements

indicated for conditions affecting performance of metal panel walls.

1. Panel Supports and Anchorage: Examine wall framing to verify that girts, angles, and other secondary structural panel support members and anchorage have been installed to meet requirements of panel manufacturer.

2. Do not proceed with wall panel installation until unsatisfactory conditions have been corrected.

B. Verify water-resistive barrier (WRB) has been properly installed over substrate, see Section 07.2726 for additional information

3.2 PREPARATION

A. Coordinate metal wall panels with rain drainage work; flashing; trim; and construction of soffits, roofing, parapets, walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

B. Promptly remove protective film, if any, from exposed surfaces of metal panels. Strip with care to avoid damage to finish. Properly dispose of all packing materials.

C. Secondary Structural Supports: Install girts, angles, and other secondary structural panel support members and anchorage according to the Light Gage Structural Institute's "Guide Specifications," Section 07410, "Manufactured Roof and Wall Panels."

D. Protect surrounding areas and adjacent surfaces from damage during execution of this work.

3.3 PANEL INSTALLATION

A. General: Comply with panel manufacturer's written instructions and recommendations for installation, as applicable to project conditions and supporting substrates. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Field cutting exterior panels by torch is not permitted.

2. Install panels with concealed fasteners.

B. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint; allow time to properly dry prior to wall panel installation.

C. Provide expansion and control joints where indicated and as required.

D. Accessories: Install components required for a complete wall panel assembly including trim, copings, fascia, mullions, sills, corner units, clips, seam covers, flashings, louvers, sealants,

gaskets, fillers, closure strips, and similar items.

E. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not otherwise indicated, types recommended by panel manufacturer.

1. Install weatherseal to prevent air and moisture penetration. Flash and seal panels at ends and intersections with other materials with rubber, neoprene, or other closures to exclude weather.

2. Seal panel end laps with a bead of tape or sealant, full width of panel. Seal side joints where recommended by panel manufacturer.

3. Prepare joints and apply sealants to comply with requirements of Division 07 Section "Joint Sealants."

F. Wall Panels: Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as necessary for waterproofing. Handle and apply sealant and back-up according to sealant manufacturer's written instructions.

1. Align bottom of wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.

2. Install screw fasteners with power tools having controlled torque adjusted to compress neoprene washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.

3. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

G. Separate dissimilar metals by painting each metal surface in area of contact with a bituminous coating or by other permanent separation as recommended by manufacturers of dissimilar metals.

H. Coat back side of metal panels with bituminous coating where it will contact wood, ferrous metal, or cementitious construction.

I. Installation Tolerances: Shim and align panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on level, plumb, and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.4 FIELD QUALITY CONTROL

A. Perform Barrier Wall Water-Spray Test: Test assembled area as directed by Architect for water

penetration in accordance with AAMA 501.2.

B. Do not cover installed air/water barriers until required inspections have been completed.

C. Obtain approval of installation procedures by air/water barrier manufacturer based on a mockup installed in place, prior to proceeding with remainder of installation.

D. Take digital photographs of each portion of installation prior to covering up.

3.5 CLEANING AND PROTECTING

A. Damaged Units: Replace panels and other components of the Work that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

B. Cleaning: Remove temporary protective coverings and strippable films, if any, as soon as each panel is installed. On completion of panel installation, clean finished surfaces as recommended by panel manufacturer and maintain in a clean condition during construction.

3.6 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION 07.4213

SECTION 07.4223 - METAL COMPOSITE MATERIAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Division 07 – Fluid Applied Air Barriers

C. Division 07 – Thermal Insulation

1.2 SUMMARY

A. Section includes metal composite material wall panels.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1. Meet with Owner, Architect, Owner's insurer if applicable, metal composite material panel Installer, metal composite material panel system manufacturer's representative, structural-support installer, and installers whose work interfaces with or affects metal composite material panels, including installers of doors, windows, and louvers.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal composite material panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal composite material panels.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for metal composite material panel assembly during and after installation.
8. Review procedures for repair of panels damaged after installation.
9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal composite material panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim and anchorage, at a scale of not less than 1-1/2 inches per 12 inches.
3. Provide signed and sealed drawings, by a qualified licensed design professional in Project jurisdiction, of MCM system showing compliance with performance requirements and design criteria identified for this Project.

C. Samples for Initial Selection: For each type of metal composite material panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Metal Composite Material Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal composite material panel accessories. Custom color sample are not available for this requirement. Standard color samples will be substituted.

E. Delegated Design Submittals: For MCM system, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports or 3rd Party Certifications: For each product, tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal composite material panels to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical metal composite material panel assembly as shown on Drawings , including corner, supports, attachments, and accessories. See division 4 for mockup description.
2. Water-Spray Test: Conduct water-spray test of mockup of metal composite material panel assembly, testing for water penetration according to AAMA 501.2.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal composite material panels, and other manufactured items so as not to be damaged or deformed. Package metal composite material panels for protection during transportation and handling.

B. Unload, store, and erect metal composite material panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal composite material panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal composite material panels to ensure dryness, with positive slope for drainage of water. Do not store metal composite material panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal composite material panels during installation.

E. Natural Metal Composite Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal composite material panels to be performed according to manufacturers' written instructions and warranty requirements.

1.10 COORDINATION

A. Coordinate metal composite material panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

A. Special Warranty: Wall Panel System Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal composite material panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
    a. Structural failures including rupturing, cracking, or puncturing.
    b. Deterioration of metals and other materials beyond normal weathering.
2. Warranty Period: (5) five years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal composite material panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
    a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 20 years plus 1 year from date of shipment from MCM panel manufacturer.

C. Panel Integrity Warranty: 10 years plus 1 year from date of shipment from MCM panel manufacturer.

PART 2 - PRODUCTS

2.1 COMPOSITE METAL PANEL MATERIALS PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal composite material panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 330:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings .
3. Deflection Limits: For wind loads, no greater than 1/180 of the perimeter span and L/60 center of panel.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:

1. Test-Pressure Difference: 1.57 lbf/sq. ft. .

C. Water Penetration under Static Pressure: No uncontrolled water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft..

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F , ambient; 180 deg F , material surfaces .

E. Fire-Resistance Ratings (When Required): Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

F. Fire Propagation Characteristics (Required 40’ above grade): Metal composite material wall panel system passes NFPA 285 testing.

2.2 METAL COMPOSITE MATERIAL WALL PANELS – **MP-1**

A. METAL COMPOSITE WALL PANEL: Metal Composite Material Wall Panel Systems: Provide factory-formed and -assembled, metal composite material wall panels fabricated from two metal facings that are bonded to a solid, extruded thermoplastic core; formed into profile for

installation method indicated. Include attachment assembly components, panel stiffeners, and accessories required for weathertight system.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Mitsubishi Plastics Composites America; Alpolic / PE or comparable product by one of the following:
    a) Alcoa Inc.; Reynobond.
    b) CENTRIA Architectural Systems.
    c) Citadel Architectural Products, Inc.
    d) Alpolic Materials.

2. Aluminum-Faced Composite Wall Panels: Formed with a minimum 0.0197-inch- thick, coil-coated aluminum sheet facings.
    1) Panel Thickness: 0.236 inch.
    2) Core: Standard.
    3) System Type: Rout and Return Dry
    4) Exterior Finish: Three-coat fluoropolymer.
        a) Color 1: Custom color to be matched by panel supplier.
        b) Color 2: Custom color to be matched by panel supplier.
        c) Color 3: Custom color to be matched by panel supplier

2.3 ACCESSORIES

A. General: Provide fabricator's standard accessories, including fasteners, clips, anchorage devices and attachments for specific applications indicated on contract documents.

2.4 RELATED MATERIALS

A. General: Refer to other related sections in Related Sections paragraph specified herein for related materials, including cold-form metal framing, flashing and trim, joint sealers, aluminum windows, glass and glazing and curtain walls.

2.5 FABRICATION

A. General: Shop fabricate to sizes and joint configurations indicated on drawings.

1. Where final dimensions cannot be established by field measurements, provide allowance for field adjustment as recommended by the fabricator.
2. Form panel lines, breaks and angles to be sharp and true, with surfaces that are free from warp or buckle.
3. Fabricate with sharply cut edges and no displacement of aluminum sheet or protrusion of core.

2.6 FINISHES

A. Factory Finish: Lumiflon-based fluoropolymer resin coating that meets or exceeds values expressed in AAMA 2605 where relevant to coil coatings.

1. Color: Custom color to be matched by panel supplier.

2.7 SOURCE QUALITY

A. Source Quality: Obtain composite panel products from a single manufacturer.

2.8 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet ASTM A 653/A 653M, G90 hot-dip galvanized coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal composite material panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal composite material panels unless otherwise indicated.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal composite material panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal composite material panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal composite material panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal composite material panels and remain weathertight; and as recommended in writing by metal composite material panel manufacturer.

2.9 FABRICATION

A. General: Fabricate and finish metal composite material panels and accessories at the factory, by panel wall system manufacturer's standard procedures and processes, as necessary to

fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Fabricate metal composite material wall panel joints that provide a weathertight seal and that minimize noise from movements.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.10 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Aluminum Panels and Accessories: To comply with AAMA 2605 or AAMA 611 as appropriate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal composite material panel supports, and other conditions affecting performance of the Work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal composite material wall panel manufacturer.
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal composite material wall panel manufacturer.
    a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and assemblies penetrating metal composite material panels to verify actual locations of penetrations relative to seam locations of metal composite material panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal composite material panel manufacturer's written recommendations.

3.3 METAL COMPOSITE MATERIAL PANEL INSTALLATION

A. General: Install metal composite material panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor metal composite material panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal composite material panels.
2. Flash and seal metal composite material panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal composite material panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.

5. Install flashing and trim as metal composite material panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal composite material panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
2. Copper Panels: Use stainless-steel fasteners.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal composite material panel manufacturer.

D. Attachment Assembly, General: Install attachment assembly required to support metal composite material wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.

1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.

E. Installation: Attach metal composite material wall panels to supports at locations, spacings, and with fasteners recommended by manufacturer to achieve performance requirements specified.

1. Wet Seal Systems: Seal horizontal and vertical joints between adjacent metal composite material wall panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 079200 "Joint Sealants."
2. Dry Seal Systems: Seal horizontal and vertical joints between adjacent metal composite material wall panels with manufacturer's standard gasket system.
3. Rainscreen Systems: Do not apply sealants to joints unless otherwise indicated.

F. Clip Installation: Attach panel clips to supports at locations, spacings, and with fasteners recommended by manufacturer. Attach routed-and-returned flanges of wall panels to panel clips with manufacturer's standard fasteners.

1. Seal horizontal and vertical joints between adjacent panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 07.9200 "Joint Sealants."

2. Seal horizontal and vertical joints between adjacent metal composite material wall panels with manufacturer's standard gaskets.

G. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal composite material panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal composite material panel manufacturer; or, if not indicated, provide types recommended in writing by metal composite material panel manufacturer.

H. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal composite material wall panel units within installed tolerance of 1/4 inch in 20 feet, non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing agency to perform field tests and inspections.

B. Water-Spray Test: After installation, test area of assembly as directed by Architect for water penetration according to AAMA 501.2.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal composite material wall panel installation, including accessories.

D. Metal composite material wall panels will be considered defective if they do not pass test and inspections as specified in AAMA 2605.

E. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

F. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal composite material panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal composite material panel installation, clean finished surfaces as recommended by metal composite material panel manufacturer. Maintain in a clean condition during construction.

B. After metal composite material panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal composite material panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07.4223

SECTION 07.5300 - THERMOSET SINGLE-PLY ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Adhered ethylene-propylene-diene-terpolymer (EPDM) Single-Ply Roofing System.
2. Membrane flashings.
3. Manufactured roof-edge metal systems associated with roofing system.
4. Roof insulation.
5. Insulation accessories and cover board.
6. Walkway pads.

B. Section includes installation of sound-absorbing insulation strips in ribs of roof deck. Sound-absorbing insulation strips are furnished under Section 05.3100 "Steel Deck."

C. Related Requirements:
1. Division 01 Section “Alternates” for Alternate roof membrane selection.
2. Division 05 Section “Steel Deck” for roof deck and sound-absorbing insulation strips
3. Division 06 Section "Rough Carpentry” for wood nailers and blocking.
4. Division 07 Section "Thermal Insulation".
5. Division 07 Section "Sheet Metal Flashing and Trim".
6. Division 07 Section "Roof Specialties".
7. Division 07 Section “NDL Warranty”.
8. Division 07 Section "Joint Sealants".
9. Division 22 Section "Storm Drainage Piping Specialties".

1.3 REFERENCES

A. American Society of Civil Engineers (ASCE)
1. ASCE/SEI 7-22 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

B. ASTM International (ASTM):
   1. ASTM C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
   2. ASTM D 624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
   3. ASTM D 4637/D4637M - Standard Specification for EPDM Sheet Used In Single-Ply Roof Membrane.
   4. ASTM D 1079 – Standard Terminology Relating to Roofing and Waterproofing.

C. FM Approvals / FM Global:
   1. FM Approvals Approval Guide.
   2. FM 4470 – Approval Standard for Single-Ply Roof Cover Assemblies.
   3. FM Global Property Loss Prevention Data Sheet 1-28 – Wind Design.
   4. FM Global Property Loss Prevention Data Sheet 1-29 – Roof Deck Securement and Above-Deck Roof Components.

D. International Code Council (ICC):
   1. International Building Code (IBC): Edition Adopted by Authority Having Jurisdiction.

E. National Roofing Contractors Association (NRCA):
   1. The NRCA Roofing Manual: Membrane Roof Systems, 2023.

F. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA):
   1. Architectural Sheet Metal Manual, Seventh Edition.

G. Underwriters Laboratories (UL):
   1. UL-790 - Standard Test Method for Fire Tests of Roof Coverings.

H. ANSI/SPRI:
   1. ANSI/SPRI/FM 4435/ES-1 – Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.

1.4 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D1079 and glossary of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section..

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Roofing Conference: Conduct conference at Project site.

   1. Meet with Owner, Architect, Construction Manager, testing and inspecting agency representative, roofing installer, roofing system manufacturer's representative, deck

installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.

2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine and review requirements for acoustic deck installation.
5. Examine deck substrate conditions and finishes, including flatness and fastening.
6. Review structural loading limitations of each roof deck type during and after roofing.
7. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
8. Review governing regulations and requirements for insurance and certificates if applicable.
9. Review temporary protection requirements for roofing system during and after installation.
10. Review roof observation and repair procedures after roofing installation.

1.6 PERFORMANCE REQUIREMENTS

A. General: Provide and install sheet membrane roofing and base flashing that are watertight; do not permit the passage of liquid water; and withstand wind loads, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.

C. Roofing System: Provide roofing system complying with requirements of authorities having jurisdiction, applicable referenced standards, and roofing system manufacturer's requirements for specified warranty.

1.7 DESIGN CRITERIA

A. Wind-Uplift Performance: Provide roofing system capable of resisting design wind-uplift pressures determined in accordance with ASCE/SEI 7-22 and applicable building code.
   1. Structural Wind Design Criteria:
      a. Risk Category: IV.
      b. Basic Wind Speed: 130mph.
      c. Wind Exposure Category: ‘C’.
      d. Component-and-Cladding Design Wind Pressures: As indicated on Structural Drawings.

2. Provide roofing system with tested or approved assembly having wind-uplift resistance not less than required design wind-uplift pressures for applicable field, perimeter, and corner roof zones.
3. Provide roofing system listed in FM Approvals RoofNav and meeting specified wind-uplift resistance requirements.
4. Provide increased attachment of roof insulation, cover board, roofing membrane, and roof-edge components at perimeter and corner zones where required to resist design wind-uplift pressures.

B. Fire Resistance Performance: Exterior-Fire-Test Exposure: ASTM E108 or UL 790, Class A; for application and roof slopes indicated.

C. Thermal Performance: Provide roofing system with minimum R-value of 33.9, or as indicated on Drawings, calculated in accordance with requirements of applicable energy code.

D. Drainage: Provide roofing system with positive drainage. Unless otherwise indicated, provide tapered insulation where required to direct water to roof drains and drainage points. Provide a roof system with positive drainage where all standing water dissipates within 48 hours after precipitation ends.

E. Roof-Edge Systems: Provide roof-edge systems tested and complying with ANSI/SPRI/FM 4435/ES-1 for design wind pressures indicated.

F. Building Codes: Provide roofing system complying with requirements of authorities having jurisdiction.

1.8 SUBMITTALS

A. Product Data: For each type of roofing product specified. Include manufacturer's data substantiating that materials comply with requirements, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:
1. Submit approved plan, section, elevation or isometric drawings which detail the appropriate methods for all flashing conditions found on the project.
2. Coordinate approved drawings with locations found on the Contract Drawings.
3. Layout and thickness of insulation.
4. Base flashings and membrane terminations.
5. Flashing details at penetrations.
6. Tapered insulation, thickness, and slopes.

7. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
8. Tie-in with air barrier.

C. Selection Samples: For each finish product specified, two complete sets of chips representing manufacturer's full range of available colors, membranes, and thicknesses:
1. Roof membrane and flashings of color required.
2. Walkway pads or rolls, of color required.

D. Verification Samples: For each finish product specified, two samples, minimum size 4 inches (100 mm) square representing actual product, color, and patterns

E. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

F. Warranty: Sample copy of manufacturer's "total system warranty" warranty stating obligations, remedies, limitations, and exclusions of warranty.

1.9 QUALITY ASSURANCE

A. Manufacturer Qualifications: All products specified in this section will be supplied by a single manufacturer with a minimum of twenty (20) years experience.

B. Installer Qualifications:
1. All products listed in this section are to be installed by a single installer with a minimum of five (5) years demonstrated experience in installing products of the same type and scope as specified.
2. Installer must be capable of extending the Manufacturer's Labor and Materials guarantee.
3. Installer must be capable of extending the Manufacturer's No Dollar Limit guarantee.

1.10 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.12 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

B. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

C. Refer to Manufacturer's Roofing System specification, Part II - Application, for General Job Site Considerations.

D. Safety Data Sheets (SDS) must be on location at all times during the transportation, storage and application of materials.

E. When positioning membrane sheets, exercise care to locate all field splices away from low spots and out of drain sumps. All field splices should be shingled to prevent bucking of water.

F. When loading materials onto the roof, the Carlisle Authorized Roofing Applicator must comply with the requirements of the building owner to prevent overloading and possible disturbance to the building structure.

G. Proceed with roofing work only when weather conditions are in compliance with manufacturer's recommended limitations, and when conditions will permit the work to proceed in accordance with the manufacturer's requirements and recommendations.

H. Proceed with work so new roofing materials are not subject to construction traffic. When necessary, new roof sections shall be protected and inspected upon completion for possible damage.

I. Provide protection, such as 3/4 inch thick plywood, for all roof areas exposed to traffic during construction. Plywood must be smooth and free of fasteners and splinters.

J. The surface on which the insulation or roofing membrane is to be applied shall be clean, smooth, dry, and free of projections or contaminants that would prevent proper application of or be incompatible with the new installation, such as fins, sharp edges, foreign materials, oil and grease.

K. New roofing shall be complete and weathertight at the end of the work day.

L. Contaminants such as grease, fats and oils shall not be allowed to come in direct contact with the roofing membrane.

1.13 WARRANTY

A. Roofing Manufacturer's Total System Warranty: Submit a written warranty, without monetary limitation, signed by roofing system manufacturer agreeing to promptly repair leaks resulting from defects in materials or workmanship for the following warranty period:

1. Warranty Period: 30 years.

2. Coverage to be extended to include Peak Wind Gusts of up to 80 mph when measured at 10 meters above ground level.

3. Coverage to be extended to include accidental punctures in accordance with terms stated in the Warranty document.

4. Coverage to be extended to include damage caused by a maximum 2 inch (51 mm) diameter hail in accordance with terms stated in the Warranty document.

5. Coverage to be extended to include roof edge metal water tightness in accordance with terms stated in the Warranty document.

B. Special Details: Details shown may, or may not, represent specific requirements for each manufacturer listed. Contractor shall provide all necessary details and components necessary to provide warranties as stated herein, at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. EPDM Sheet:

a. Carlisle Syntec Systems; Carlisle Corp. Basis of Design.
b. Elevate.
c. Johns Manville.

2. Polyisocyanurate Board Insulation: (As approved by membrane manufacturer for total system warranty.)

2.2 SCOPE / APPLICATION

A. Roof System: Provide a waterproof roof system, capable of withstanding uplift forces as specified in Design Criteria.

B. Base Flashing: Provide a waterproof, fully adhered base flashing system at all penetrations, plane transitions and terminations.

C. Insulation: Provide a roof insulation system beneath the finish membrane.

2.3 INSULATION

A. SecurShield Polyiso: Rigid board with coated glass fiber mat facers (CGF) on both sides, meeting or exceeding the requirements of ASTM C 1289, Type II, Class 2.
1. Compressive Strength: Grade 2 (20 psi) (138 kPa).
2. Density: 2 lb. per cubic foot (24 kg/cu m) minimum.

B. SecurShield HD Polyiso Cover board: Rigid board with coated glass fiber mat facers (CGF) on both sides, meeting or exceeding the requirements of ASTM C 1289, Type II, Class 4, Grade 1
1. Compressive Strength: 80 psi min. (751 kPa).
2. Board Thickness: 1/2 inch (13 mm).

2.4 ETHYLENE-PROPYLENE-DIENE-TERPOLYMER (EPDM) MEMBRANE – BASE BID

A. EPDM Sheet: Sure-Seal FleeceBACK Membrane: Cured, non-reinforced EPDM membrane with a 55 mil fleece bonded to the underside. Meets the requirements of ASTM D 4637 Type I.
1. Attachment: Fully adhered with Flexible FAST adhesive.
2. Membrane Thickness: 145 mil nominal / 90 mil over fleece.
3. Exposed Face Color: Black.
4. Sheet Dimensions:
a. Width: 10 feet (3.04 m) minimum.
b. Length: 100 feet (30.5 m) maximum.
5. Performance:
a. Breaking Strength: 200 lbf (890 N) minimum.
b. Tear Strength: 45 lbf (200 N) minimum.
c. Elongation: 480 percent.

2.5 ETHYLENE-PROPYLENE-DIENE-TERPOLYMER (EPDM) MEMBRANE – ALTERNATE BID

A. This paragraph 2.5 shall apply only if the Owner chooses to accept the Alternate Roof Membrane Alternate as described in Division 01, Section 'Alternates' and on the Bid Form.

B. EPDM Sheet: Uniform, flexible sheet formed from a terpolymer of ethylene-propylene-diene, reinforced, complying with ASTM D 4637, Type II, of the following grade, class, thickness, backing, and exposed face color:
   1. Attachment: Fully adhered with Flexible FAST adhesive.
   2. Membrane Thickness: 90 mils, nominal.
   3. Exposed Face Color: Black.
   4. Sheet Dimensions:
      a. Width: 10 feet (3.04 m) minimum.
      b. Length: 100 feet (30.5 m) maximum.
   5. Performance:
      a. Breaking Strength: 200 lbf minimum.
      b. Tear Strength: 125 lbf minimum.
      c. Elongation: 465 percent.

2.6 CLEANERS, PRIMERS, ADHESIVES AND SEALANTS

A. Carlisle Weathered Membrane Cleaner: Clear, solvent-based cleaner used to loosen and remove contaminants from the surface of exposed EPDM membrane prior to applying EPDM Primer.

B. Flexible FAST Adhesive: A spray or extruded applied, two-component, polyurethane, low-rise expanding foam adhesive used to securely bond FleeceBACK membranes to a variety of substrates.

C. CAV-GRIP III Low-VOC Aerosol Contact Adhesive/Primer: a low-VOC, methylene chloride-free adhesive that can be used for a variety of applications including priming unexposed asphalt prior to applying Flexible FAST Adhesive, adhering Sure-Seal EPDM, horizontally, for the field of the roof, and for adhering Sure-Seal FleeceBACK and Sure-Seal EPDM membrane to vertical walls. Coverage rate is approximately 2,000-2,500 sq. ft. per 40 lb. cylinder and 4,000-5,000 sq. ft. per 85 lb. cylinder as a primer, in a single-sided application and 750 sq. ft. per 40 lb. cylinder and 1,500 sq. ft. per 85 lb. cylinder as an adhesive for vertical walls, in a double-sided application; 1,000 sq. ft. per 40 lb. cylinder and 2,000 sq. ft. per 85 lb. cylinder as an adhesive, horizontally, for the field of the roof, in a double-sided application.

2.7 FASTENING COMPONENTS

A. HP Fastener: Threaded, black epoxy electro-deposition coated (E-Coat) fastener for use with steel, wood plank or oriented strand board (OSB).

B. InsulFast Fasteners: Threaded, #12 fastener with #3 Phillips head used with 3 inch (76 mm) diameter insulation Plates. For insulation attachment into steel or wood decks.

C. Insulation Fastening Plate: Nominal 3 inch (76 mm) diameter FM approved metal plate used for insulation attachment.

2.8 EDGINGS AND TERMINATIONS

A. Pre-manufactured Metal Coping Cap System Carlisle SynTec Systems SecureEdge 200 or approved equal.
   1. All components including corrosion resistant fasteners to be used in the copings shall be furnished by the manufacturer. Metal shall be 0.050" aluminum with Kynar custom color finish as selected by the Architect.
   2. Anchor chairs shall be 16 ga. galvanized x 16" long and spaced at 40" o.c..
   3. All submittals for approved equals shall conform to Sections 1.9 Quality Assurance and 1.7 Design Criteria.
   4. Provide a manufacturer's Edge-to-Edge warranty: Warranted materials shall be free of defects in material and workmanship. The manufacturer will also furnish their standard decorative finish warranty.
   5. The coping cap corners and transitions shall have continuous factory welded seams.
   6. Extenders shall be fabricated from 0.050" aluminum with specified Kynar finish.

B. Pre-Manufactured Metal Edge Snap on Fascia System: Carlisle SynTec Systems SecureEdge 200 or Approved Equal.
   1. Metal shall be aluminum, ASTM B209, alloy 3105-H14, in thickness of 0.050" nominal with Kynar 500 or approved equal. Color shall be a custom color as selected by the Architect.
   2. Cant Dam shall be 22 ga. galvanized and continuous for the entire roof edge.
   3. All submittals for approved equals shall conform to Sections 1.5 Quality Assurance and 1.8 Design & Performance Criteria.
   4. Provide a manufacturer's Edge-to-Edge roof warranty. Warranted materials shall be free of defects in material and workmanship for five years after shipment. The manufacturer will also furnish their standard decorative finish warranty.
   5. Extenders shall be fabricated from 0.050" aluminum with Kynar 500 or approved equal.
   6. Color to match metal edge snap on fascia system.

C. Sure-Seal Termination Bar: 1 inch (13 mm) wide, .098 inch (2.5 mm) thick extruded aluminum bar pre-punched 6 inches (152 mm) on center with sealant ledge to support Lap Sealant.

2.9 ACCESSORY ROOFING MATERIALS

A. General: Accessory materials recommended by roofing system manufacturer for intended use and compatible with EPDM membrane roofing system and other roofing components.

1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: 90 mil (2.3 mm) thick EPDM, partially cured or cured, according to application.

C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

D. Bonding Adhesive: Manufacturer's standard bonding adhesive for the specified material.

E. Splice Adhesive and Cleaner: Single-component butyl splicing adhesive and solvent-based splice cleaner. Splice Primer and Tape: Manufacturer's standard synthetic rubber polymer primer and 3-inch- (75-mm-) wide minimum, butyl splice tape with release film.

F. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.

G. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

H. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; roll formed and prepunched with anchors.

I. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening components to substrate, and acceptable to roofing system manufacturer.

J. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, molded pipe boot flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories recommended by roofing system manufacturer for intended use.

1. Provide black flashing accessories for the black EPDM membrane roofing.

2.10 INSULATION ACCESSORIES AND COVER BOARD

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.

B. Fasteners: Factory-coated steel fasteners and metal plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

2.11 WALKWAYS

A. Walkway Pads: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads, approximately 3/16 inch (5 mm) thick, and acceptable to roofing system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
4. Verify that concrete substrate is visibly dry and free of moisture, and that minimum concrete internal relative humidity is not more than **75** percent, or as recommended by roofing system manufacturer when tested according to ASTM F2170.

    a. Test Frequency: One test probe per each 1000 sq. ft. , or portion thereof, of roof deck, with not less than three test probes.
    b. Submit test reports within 24 hours of performing tests.

5. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Install sound-absorbing insulation strips according to acoustical roof deck manufacturer's written instructions.

3.3 INSULATION - SYSTEM DESIGN - SLOPED DECKS

A. Base Layer:
   1. Type: SecurShield Polyiso.
   2. ***Thickness: 3 inches.***
   3. Attachment Method: Commonly fastened.

B. Next Layer:
   1. Type: SecurShield Polyiso.
   2. Thickness: 2.5 inches.
   3. Attachment Method: Mechanically fastened to deck below.

C. Tapered System:
   1. Type: SecurShield Polyiso.
   2. Sump Slope: 1/2 inch per foot.
   3. Cricket Slope: 1/2 inch per foot.
   4. Attachment Method: Mechanically fastened to deck below..

D. Top Layer:
   1. Type: SecurShield HD Polyiso.
   2. Thickness: 1/2 inch.
   3. Attachment Method: Adhered to insulation layers below.

3.4 INSULATION - SYSTEM DESIGN - FLAT DECKS

A. Base Layer:
   1. Type: SecurShield Polyiso.
   2. Thickness: 3.5 inches.
   3. Attachment Method: Commonly fastened..

B. Tapered System:
   1. Type: SecurShield Polyiso.
   2. Starting thickness: 1/2 inch.
   3. Field Slope: 1/4 inch per foot.
   4. Sump Slope: 1/2 inch per foot.
   5. Cricket Slope: 1/2 inch per foot.
   6. Attachment Method: Mechanically fastened to deck below.

C. Top Layer:
   1. Type: SecurShield HD Polyiso.

2. Thickness: 1/2 inch.
3. Attachment Method: Adhered to insulation layers below.

3.5 INSTALLATION OF ROOFING, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions and assembly requirements.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

C. Install insulation or membrane underlayment in multiple layers over the substrate with boards butted tightly together with no joints or gaps greater than 1/4 inch (6 mm). Stagger joints both horizontally and vertically.

D. Secure insulation to the substrate with the required mechanical fasteners or insulation adhesive in accordance with the manufacturer's current application guidelines.

E. Do not install wet, damaged or warped insulation boards.

F. Stagger joints in one direction unless joints are to be taped. Install insulation boards snug. Gaps between board joints shall not exceed 1/4 inch (6 mm). Fill all gaps in excess of 1/4 inch (6 mm) with same insulation material.

G. Wood nailers must be at least 3 1/2 inches (89 mm) wide or 1 inch (25 mm) wider than adjacent metal flange. Thickness must equal that of insulation but not less than 1 inch (25 mm) thickness.

H. Miter and fill the edges of the insulation boards at ridges, valleys and other changes in plane to prevent open joints or irregular surfaces. Avoid breaking or crushing of the insulation at the corners.

I. Do not install any more insulation than will be completely waterproofed each day.

3.6 INSULATION PLACEMENT (Metal Decks)

A. Install insulation or membrane underlayment in multiple layers over the substrate with boards butted tightly together with no joints or gaps greater than 1/4 inch (6 mm). Stagger joints both horizontally and vertically.

B. Secure insulation to the substrate with the required mechanical fasteners or insulation adhesive in accordance with the manufacturer's current application guidelines.

C. Do not install wet, damaged or warped insulation boards.

D. Stagger joints in one direction unless joints are taped. Install insulation boards snug. Gaps between board joints shall not exceed 1/4 inch (6 mm). Fill all gaps in excess of 1/4 inch (6 mm) with same insulation material.

E. Wood nailers must be at least 3 1/2 inches (89 mm) wide or 1 inch (25 mm) wider than adjacent metal flange. Thickness must equal that of insulation but not less than 1 inch (25 mm) thickness.

F. Miter and fill the edges of the insulation boards at ridges, valleys and other changes in plane to prevent open joints or irregular surfaces. Avoid breaking or crushing of the insulation at the corners.

G. Do not install any more insulation than will be completely waterproofed each day.

3.7 COVER BOARDS

A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction.

1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
2. At internal roof drains, conform to slope of drain sump.

    a. Trim cover board so that water flow is unrestricted.

3. Cut and fit cover board tight to nailers, projections, and penetrations.
4. Adhere cover board to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
    a. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

3.8 MEMBRANE PLACEMENT AND ATTACHMENT (FleeceBACK Fully Adhered)

A. Position and unroll successive sheets and align to provide for a minimum 3 inch (76 mm) wide splice.

B. Fold adjacent sheets in-half lengthwise to expose an approximate 10 foot (3046 mm) wide substrate area.

C. Membrane which will have the adjacent sheet spliced over it should be adhered to the substrate first. In this fashion, selvage edge splice area will not be contaminated by setting splice edge into the FAST or Flexible FAST Adhesive.

D. Spray or extrude FAST or Flexible FAST Adhesive onto the substrate and allow to foam up approximately 1/8 inch (3 mm). Wait for the adhesive to achieve "string" when a small object is lifted out if the adhesive.

E. Place the membrane into adhesive after adhesive develops strings when touched, typically 1-1/2 to 2 minutes after adhesive was applied and roll with a 150 lb. (68 kg) segmented weighted roller.

F. Apply FAST Adhesive to the substrate and continue process described above until all sheets are fully bonded, allowing for necessary splice overlaps at selvage edges. At end laps (along the width of the sheet) membrane shall be butted together which will be overlaid with 6 inch wide Pressure-Sensitive Cured Cover Strip or Pressure-Sensitive Overlayment Strip.

3.9 MEMBRANE SPLICING (Tape Splice)

A. Overlap adjacent sheets and mark a line 1/2 inch out from the top sheet.

B. Fold the top sheet back and clean the dry splice area (minimum 2 1/2 inches (64 mm wide) of both membrane sheets with Sure-Seal Primer as required by the membrane manufacturer.

C. Where Splice Tape is not Factory-Applied, apply Splice Tape to bottom sheet with the edge of the release film along the marked line. Press tape onto the sheet using hand pressure. Overlap tape roll ends a minimum of 1 inch (13 mm).

D. Remove the release film and press the top sheet onto the tape using hand pressure.

E. Roll the seam toward the splice edge with a 2 inch (51 mm) wide steel roller.

F. Install Pressure-Sensitive "T" Joint Cover, a 6 inch wide (152 mm) section of Pressure-Sensitive Elastoform Flashing over all field splice intersections.

G. When using non-Pressure-Sensitive Elastoform Flashing or Elastoform Flashing, seal edges of flashing with Lap Sealant.

H. The use of Lap Sealant with tape splices is optional except at tape overlaps and cut edges of reinforced membrane where Lap Sealant is required.

3.10 BASE FLASHING

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.11 WALKWAYS

A. Flexible Walkways: Install walkway products according to manufacturer's written instructions.

1. Install flexible walkways at the following locations:

    a. Perimeter of each rooftop unit.
    b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
    c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
    d. Top and bottom of each roof access ladder.
    e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
    f. Locations indicated on Drawings.
    g. As required by roof membrane manufacturer's warranty requirements.

2. Provide 6-inch (152-mm) clearance between adjoining pads.
3. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.12 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for

deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction PRIOR to Substantial Completion

END OF SECTION 07.5300

SECTION 07.6200 – SHEEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes sheet metal flashing and trim in the following categories:

1. Exposed Trim
2. Scuppers, Collector Heads and Downspouts
3. Gutters and Downspouts
4. Metal Drip Edge
5. Metal Flashings
6. Reglet Mounted Counterflashings
7. Surface Mounted Counterflashings
8. Roof Penetrations

1.3 RELATED SECTIONS

A. Related sections:

1. Division 06 Section “Miscellaneous Rough Carpentry” for wood nailers, curbs, and blocking, and plywood backing for brake metal fabrications and sheathing panels.
2. Division 07 Section “Joint Sealants”
3. Division 07 Section “ Roof Insulation”
4. Division 07 Section “Modified Bituminous Membrane Roofing-Hot Applied”
5. Division 22 Section “Plumbing”

1.4 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing.

B. ANSI/SPRI ES-1 (Pre-Manufactured Metal Coping Cap System & Pre-Manufactured Metal Edge Fascia System)

1. ANSI/SPRI ES-1 test reports must be submitted for specific project wind uplift requirements per Section 1.16 Design and Performance Criteria within Modified Bituminous Membrane Roofing specification.

C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.5 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data including manufacturer's material and finish data, installation instructions, and general recommendations for each specified flashing material and fabricated product.

C. Shop Drawings of each item specified showing layout, profiles, methods of joining, and anchorage details.

D. Samples of sheet metal flashing, trim, and accessory items, in the specified finish. Where finish involves normal color and texture variations, include Sample sets composed of two or more units showing the full range of variations expected.

1. 8-inch-square Samples of specified sheet materials to be exposed as finished surfaces.
2. 12-inch-long Samples of factory-fabricated products exposed as finished Work. Provide complete with specified factory finish.

E. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

F. Certification

1. Submit roof manufacturer's certification that metal fasteners furnished are acceptable to roof manufacturer.

G. Manufacturer's Product Data

1. Metal material characteristics and installation recommendations.

2. Submit color chart prior to material ordering and/or fabrication so that equivalent colors to those specified can be approved.

H. ANSI/SPRI ES-1 (Pre-Manufactured Metal Coping Cap System & Pre-Manufactured Metal Edge Fascia System)

1. Test report must be submitted for specific project wind uplift requirements per Section 1.16 Design and Performance Criteria within Modified Bituminous Membrane Roofing specification.

1.6 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

1. Copper Standard: Comply with CDA's "Copper in Architectural Handbook."

B. Installer Qualifications: Engage an experience Installer who has completed sheet metal flashing and trim work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

1.7 PRODUCT HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.8 COORDINATION

A. Coordinate Work of this Section with interfacing and adjoining Work for proper sequencing of each installation. Ensure best possible weather resistance, durability of Work, and protection of materials and finishes.

1.9 WARRANTY

A. Manufacturer's Warranty

1. Pre-finished metal material shall require a written 30-year non-prorated warranty covering fade, chalking and film integrity. The material shall not show a color change greater than 5 NBS color units per ASTM D-2244 or chalking excess of 8 units per ASTM D-659. If either occurs material shall be replaced per warranty, at no cost to the Owner.

2. Warranty shall also include the EPDM roof system's pre-manufactured metal coping cap system, and the transition between all systems, and shall be a single-source edge-to-edge warranty provided by ONE manufacturer.

3. At the request of the Owner, the Manufacturer will provide an annual inspection. The request for annual inspections shall be applicable for the life of the warranty.

B. Contractor's Warranty

1. The Contractor shall provide the Owner with a notarized written warranty assuring that all sheet metal work including caulking and fasteners to be watertight and secure for a period of three (3) years from the date of final acceptance of the building. Warranty shall include all materials and workmanship required to repair any leaks that develop and make good any damage to other work or equipment caused by such leaks or the repairs thereof.

PART 2 - PRODUCTS

2.1 METALS

A. Copper: ASTM B 370; temper H00, cold rolled except where temper 060 is required for forming; not less than 16 oz./sq. ft., unless otherwise indicated in the project documents.

B. Lead-Coated Copper: ASTM B 101, cold-rolled copper sheet, not less than 20 oz./sq. ft., both sides coated with lead weighing not less than 12 or more than 15 lb/100 sq. ft., unless otherwise indicated.

C. Aluminum: Sheet Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated and with not less than the strength and durability of alloy and temper designated below:

1. Mill Finish: Standard one side bright with a minimum thickness of 0.040 inch.
2. Polyvinylidene fluoride (Kynar) Factory Finish Aluminum Sheet: ASTM B 209, 3105-H14, with a minimum thickness of 0.050 inch, unless listed otherwise. Aluminum shall be coated on both sides with an epoxy primer and on the weathering surface with a polyvinylidene fluoride (Kynar) coated finish.

    a. Minimum thickness of Aluminum to be specified in accordance with SMACNA's Architectural Sheet Metal Manual.

    b. Color shall be a **custom** color as selected by Architect. Area divider covers, equipment counterflashings, and slip flashings shall be mill finish.

D. Stainless Steel Sheet: ASTM A240, Type 304.

1. Finish: No. 2D (dull, cold rolled).

E. Lead Sheet: ASTM B 749, Type L51121, copper-bearing lead sheet with a minimum thickness of 0.0675 inch, except not less than 0.0937-inch-thick for applications where burning (welding) is involved.

F. Lead Flashing Sheet for Drains & Vent Pipes: Meets Federal Specification QQ-L-201, Grade B, four (4) pounds per square foot.

2.2 MANUFACTURED TWO PIECE REGLETS AND COUNTERFLASHING

A. Manufacturers: Subject to compliance with requirements, provide one of the following:

1. Cheney Flashing Company
2. Fry Reglet Corporation
3. Keystone Flashing Company

B. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated:

1. Material: Stainless steel, 0.0187 inch thick.

2. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials or a minimum of 4".

3. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.

4. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.

5. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of the counterflashing lower edge.

C. Counterflashings: Provide counterflashing fabricated in the profile indicated and from the following metal in thickness, as indicated:

1. Formed to cover roof flashing system a minimum of four (4) inches below the termination bar. Side/end laps of three (3) inches minimum.

2. Stainless steel, 0.0187 inch thick.

2.3 REGLET MOUNTED COUNTERFLASHINGS

A. General: Shall be a one (1) piece shop fabricated type counterflashing. Units of type, material, and profile indicated, formed to cover roof flashing system a minimum of four (4) inches below the termination bar.

B. Material: 0.050 aluminum or 20 oz. copper as indicated on the project details/drawings. Where the existing metal flashing is to remain, the materials shall be the same as the existing metal flashing.

C. Provide lead wedges at 12" on center to sure the counterflashing in the sawcut joint. Provide polyurethane sealant at top edge.

2.4 SURFACE MOUNTED COUNTERFLASHINGS

A. General: Shall be a one (1) piece shop fabricated type counterflashing. Units of type, material, and profile indicated, formed to cover roof flashing system a minimum of four (4) inches below the termination bar.

B. Material: 0.050 aluminum or 20 oz. copper as indicated on the project details/drawings. Where the existing metal flashing is to remain, the materials shall be the same as the existing metal flashing.

C. Surface-Mounted Type: Provide with holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.

2.5 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Underlayment: Ply of specified base flashing modified membrane or approved equal.

C. Fasteners:

1. Nails and Fasteners: Non-ferrous metal or hot dipped galvanized fasteners complying with ASTM A153 and connectors complying with ASTM A653, Class G185; Type 304 or Type 316 stainless steel fasteners and connectors shall be used with new generation of pressure-treated wood; except that hard copper nails shall be used with copper; aluminum or stainless steel nails shall be used with aluminum; and stainless steel nails shall be used with stainless steel. Fasteners shall be self-clinching type of penetrating type as recommended by the manufacturer of the wood blocking/nailer material. Nails and fasteners shall be flush-driven through flat metal discs of not less than one (1) inch diameter. Omit metal discs when one-piece composite nails or fasteners with heads not less than one (1) inch diameter are used.

2. Fastening shall conform to ANSI/SPRI ES-1 or as stated on section details, whichever is more stringent and per the manufacturer's requirements.

D. Metal Drip Edge: Kynar finished Aluminum, 0.050-inch-thick, with continuous cleat.

E. Equipment Support/Slip Flashing: Mill finished Aluminum, 0.040 inch thick.

F. Metal Expansion Joints: 20 oz. copper.

G. Scuppers and Collector Heads: Kynar finished Aluminum, 0.050-inch-thick with fully welded seams and 4" deck flanges.

H. Escutcheon Plates: Kynar finished Aluminum, 0.050 inch thick.

I. Gutters: Box gutter with deck flange type. Kynar finished aluminum, 0.050-inch-thick with 2" wide x 1/8" thick Kynar coated, or Kynar aluminum cladded, aluminum external brackets at 30" on center, and 2" wide x double-folded 0.050" thick aluminum internal straps at 30" on center. Stagger the internal straps and the external brackets.

J. Downspouts: Kynar finished aluminum, 0.050-inch-thick with 2" wide x 0.050-inch double folded hold down straps at 5' on center secured to the building exterior wall and as indicated on the Drawings.

K. Pitch Pockets: 20 oz. copper.

L. Solder for Stainless Steel: ASTM B 32, Grade Sn60, used with an acid flux of type recommended by stainless-steel sheet manufacturer; use a noncorrosive rosin flux over tinned surfaces.

M. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.

N. Solder for Lead: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.

O. Fasteners and Rivets: Same metal as sheet metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with material being fastened.

P. Asphalt Mastic: SSPC-Paint 12, solvent-type asphalt mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil dry film thickness per coat.

Q. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

R. Sealing Tape: Pressure sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

S. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim, and remain watertight.

T. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

U. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

V. Adhesives: Type recommended by flashing sheet metal manufacturer for waterproof and weather-resistant seaming and adhesive application of flashing sheet metal.

W. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of Work, matching or compatible with material being installed; noncorrosive; size and thickness required for performance.

X. Roofing Cement: ASTM D 4586, Type I, asbestos free, asphalt based, of consistency required for application.

2.6 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations of SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of the item indicated. Shop fabricate items were practicable. Obtain field measurements for accurate fit before shop fabrication.

B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

C. Comply with details shown to fabricate sheet metal flashing and trim that fit substrates and result in waterproof and weather-resistant performance once installed. Review with designer and verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

D. Form exposed sheet metal work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems.

E. Seams: Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength. Tin edges to be seamed, form seams, and solder.

F. Expansion Provisions: Provide slotted or oversized fastener holes in metal trim pieces to allow for expansion. Space movement joints at maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used, or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

G. Sealed Joints: Form nonexpanding, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.

H. Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact with asphalt mastic or other permanent separation as recommended by manufacturer.

I. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.

J. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer.

1. Size: As recommended by SMACNA manual or sheet metal manufacturer for application but never less than thickness of metal being secured.

2.7 ALUMINUM EXTRUSION FABRICATIONS

A. Aluminum Extrusion Units: Fabricate extruded-aluminum running units with formed or extruded-aluminum joint covers for installation behind main members where possible. Fabricate mitered and welded corner units at all areas calling for metal coping caps.

2.8 ALUMINUM FINISHES

A. General: Comply with Aluminum Association's (AA) "Designation System for Aluminum Finishes" and NAAMM's “Metal Finishes Manual for Architectural and Metal Products” for finish designations and application recommendations.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable in they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions under which sheet metal flashing and trim are to be installed and verify that Work may properly commence. Verify that the substrate is sound, dry, smooth, clean sloped for drainage, and securely anchored. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer's installation instructions, and SMACNA's

"Architectural Sheet Metal Manual." Anchor units of Work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install Work with laps, joints, and seams that will be permanently watertight and weatherproof.

B. Install exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

C. Roof-Edge Flashings: Secure metal flashings at roof edges according to ANSI/SPRI ES-1 for the specific project wind uplift requirements per Section 1.15 Design and Performance Criteria within the Modified Bituminous Membrane Roofing specification.

D. Expansion Provisions: Provide for thermal expansion of exposed sheet metal Work. Incorporate slotted or oversized fastener holes in sheet metal trim pieces to allow for expansion and contraction. Space movement joints at maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used, or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

E. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches, except where pretinned surface would show in finished Work.

F. Sealed Joints: Form nonexpanding, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards. Fill joint with sealant and form metal to completely conceal sealant.

1. Use joint adhesive for nonmoving joints specified not to be soldered.

G. Seams: Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

H. Separations: Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces, at locations of contact, with asphalt mastic or other permanent separation as recommended by manufacturer.

1. Underlayment: Where installing stainless steel or aluminum directly on cementitious or wood substrates, install a slip-sheet of modified base flashing membrane as specified in the Modified Bituminous Membrane Roofing specification or EPDM rubber.
2. Bed flanges of Work in a thick coat of roofing cement where required for waterproof performance.

I. Slip Counterflashing: Coordinate installation of counterflashing with installation of assemblies to be protected by counterflashing. Install counterflashing as indicated on the drawings, by the Engineer, or by the roofing membrane manufacturer. End joints shall be overlapping not less than 3" and secured together. Corners shall be mitered and fabricated to a watertight condition. The bottom of the counterflashing shall project ¼" from the face of the wall with a down turned drip edge and cover the roof flashing system a minimum of four (4) inches below the termination bar. Install counterflashing system in accordance with plan details and in accordance with referenced standards. Secure with approved fasteners having a neoprene gasketed waterproofing washer at 8" on center minimum.

J. Surface Mounted Counterflashings: Secure counterflashing with approved fasteners at 8" on center. Seal top of counterflashing with a continuous bead of the polyurethane sealant. End joints shall be overlapping not less than 3" and secured together. Corners shall be mitered and fabricated to a watertight condition. The bottom of the counterflashing shall project ¼" from the face of the wall with a downturned drip edge and cover the roof flashing system a minimum of four (4) inches below the termination bar. Install counterflashing system in accordance with plan details and in accordance with referenced standards.

K. Counterflashings: Coordinate installation of counterflashings with installation of assemblies to be protected by counterflashing. Install counterflashings in reglets or receivers. Secure in a waterproof manner by means of snap-in installation and sealant, lead wedges and sealant, interlocking folded seam, or blind rivets and sealant. Lap counter flashing joints a minimum of 3 inches and bed with sealant.

L. Reglet Mounted Counterflashings: Coordinate installation of counterflashing receiver. Saw cut mortar joint to proper depth to accept new reglet mounted counterflashing. Secure counterflashing with lead plugs at 12" on center. Seal top of counterflashing with a continuous bead of the specified polyurethane sealant. End joints shall be interlocking and overlapping not less than 3". Corners shall be mitered and sealed to a watertight condition. The bottom of the cap flashing insert shall project ¼" from the face of the wall with a downturned drip edge (provide a downturned hem in areas subject to human contact). The new counterflashing shall cover the roof flashing system a minimum of four (4) inches below the termination bar. Install counterflashing system in accordance with plan details and in accordance with referenced standards and manufacturer's instructions.

M. Drain Flashing: Coordinate roof-penetration flashing installation with roofing and installation of drains. Install lead flashing as follows:

1. Turn lead flashing down inside drain a minimum of two (2) inches.

N. Roof-Penetration Flashing: Coordinate roof-penetration flashing installation with roofing and installation of items penetrating roof. Install lead flashing as follows:

1. Turn lead flashing down inside vent piping a minimum of one (1) inch, being careful not to block vent piping with flashing.
2. Seal and clamp flashing to pipes penetrating roof, other than lead flashing on vent piping.

O. SCUPPER THROUGH ROOF EDGE

1. Install new wood nailers as required in scupper opening to allow for the installation and securement of the new through edge scupper.

2. Install new scupper box in a 1/4" bed of mastic and secure to the wood nailers and masonry wall in accordance with manufacturer's recommendations and details. Assure all
box seams are welded and have a minimum 4" flange. Make sure all corners are closed,
and welded.

3. Prime metal edge at a rate of 100 square feet per gallon and allow to dry.

4. Install specified 2-ply roof flashing system as specified above.

5. Install aluminum escutcheon plate behind scupper.

3.3 CLEANING AND PROTECTION

A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

B. Provide final protection and maintain conditions that ensure sheet metal flashing and trim Work during construction is without damage or deterioration other than natural weathering at the time of Substantial Completion.

C. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup, or similar minor repair procedures.

END OF SECTION 07.6200

SECTION 07.7100 - MANUFACTURED ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Copings.
   2. Fascia and gravel stops.
   3. Manufactured reglets and counterflashing.

B. Related Sections include the following:
   1. Division 05 Section "Metal Fabrications": Metal downspout boots.
   2. Division 06 Section "Rough Carpentry": Wood plates and nailers.
   3. Division 07 Section "EPDM Membrane Roofing"
   4. Division 07 Section "Joint Sealants": Requirements for field-applied joint sealants.

1.2 SUBMITTALS

A. Product Data: For each type of product specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.

B. Shop Drawings: Indicate layout, joining, profiles, accessories, anchorage, flashing connections, and relationship to supporting structure and to adjoining roof and wall construction.

C. Samples for Verification: Samples of actual products not less than 12 inches long showing factory-applied color finishes.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide manufactured roof specialties capable of withstanding wind loads, structural movement, thermally induced movement, and exposure to weather without failing.

B. Provide manufactured roofing specialties, incorporating roof edge treatment that complies with recommendations of FM Loss Prevention Data Sheet 1-49 for the following Wind Zone:
   1. Wind Zone 1: Wind pressures of 21 to 30 lbf/sq. ft.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of manufactured roof specialty from one source and by a single manufacturer.

1.5 PROJECT CONDITIONS

A. Coordinate work of this Section with adjoining work for proper sequencing of each installation to ensure best-possible weather resistance and protection of materials and finishes against damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Formed-Aluminum Copings:
      a. W.P. Hickman Co.
      b. Metal-Era, Inc.
      c. MM Systems Corp.
      d. Petersen Aluminum Corp.
      e. Southern Aluminum Finishing Co.
   2. Formed-Aluminum Fascia and Gravel Stops:
      a. ATAS International, Inc.
      b. Architectural Products Co.
      c. W.P. Hickman Co.
      d. Metal-Era, Inc.
      e. MM Systems Corp.
      f. Southern Aluminum Finishing Co.
   3. Reglets and Counterflashing:
      a. Cheney Flashing Company.
      b. Fry Reglet Corporation.
      c. Keystone Flashing Company.

2.2 METALS

A. Aluminum Extrusions: ASTM B 221, 6063-T5 alloy and temper, or as recommended by manufacturer for use intended and as required for proper application of finish indicated.

B. Aluminum Sheet: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for use intended and finish indicated, and with not less than the strength and durability of alloy and temper designated below:
   1. Alloy 3003-H14, with a minimum thickness of 0.050 inch, unless otherwise indicated, for aluminum sheet with mill finish.
   2. Alloy 5005-H14, with a minimum thickness of 0.050 inch, for aluminum sheet with other than mill finish.

C. Galvanized Steel Sheets: ASTM A 653, G90 coating designation; commercial quality; at least 0.034 inch thick, unless otherwise indicated.

D. Coil-Coated Galvanized Steel Sheet: Galvanized steel sheet prepainted by coil-coating process with indicated coating complying with ASTM A 755.

E. Stainless-Steel Sheet: ASTM A 666, Type 304, soft annealed, with No. 2D finish, unless harder temper is required for forming or performance; at least 0.0187 inch thick, unless otherwise indicated.

2.3 COPINGS

A. Provide copings in shapes and sizes indicated, with shop-fabricated corners. Include anchor plates formed from at least 0.028-inch-thick, galvanized steel sheet; cleats or other attachment devices; concealed splice plates; and trim and other accessories indicated or required for complete installation, of materials compatible with the specified finish material and with no exposed fasteners.

B. Provide exposed coping components fabricated from the following metal:
   1. Formed-aluminum sheet in thickness indicated, but not less than 0.050 inch.

C. Basis of Design: Hickman, Roofer's Edge Coping.
   1. Color: Custom color and gloss as selected by the Architect.
   2. Sizes as detailed on the Drawings.

2.4 FASCIA AND GRAVEL STOPS

A. Provide gravel stops and fascia assemblies in shapes and sizes indicated, with shop-mitered and -welded corners. Include water dams formed from at least 0.028-inch-thick, galvanized steel sheet; anchor plates; cleats or other attachment devices; concealed splice plates; and trim and other accessories indicated or required for complete installation, with no exposed fasteners.

B. Provide exposed gravel stop components fabricated from the following metal:
   1. Formed-aluminum sheet in thickness indicated, but not less than 0.050 inch.

C. Basis of Design: ATAS, Edge-Lok 2 Fascia; and ATAS Gravel Stop Fascia.
   1. Color: Custom color and gloss as selected by the Architect.
   2. Sizes as detailed on the Drawings.

2.5 REGLETS

A. General: Provide reglets of type, material, and profile indicated, compatible with flashing. Form to securely interlock with counterflashing.

B. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials; special fasteners for attaching reglet to concrete forms; and guides to ensure alignment of reglet section ends.

C. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.

D. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of the counterflashing's lower edge.

E. Material: Fabricate reglets from the following metal in thickness indicated:
   1. Stainless-steel sheet, 0.0187 inch thick; for reglets and receivers in contact with concrete or masonry.
   2. Aluminum sheet, 0.024 inch thick; for reglets not in contact with concrete or masonry.

2.6 COUNTERFLASHING

A. Provide 2-piece counterflashings fabricated from the following metal in thickness indicated:
   1. Stainless steel; 0.0187 inch thick.

2.7 ACCESSORIES

A. General: Provide manufacturer's standard accessories designed and manufactured to match and fit roof edge treatment system indicated.

B. Exposed Fasteners: Stainless steel, nonmagnetic, of manufacturer's standard type and size for product and application indicated. Match finish of exposed heads with material being fastened.

C. Concealed Fasteners: Same metal as item fastened or other noncorrosive metal as recommended by manufacturer.

D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

E. Asphalt Mastic: SSPC-Paint 12, solvent-type asphalt mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil dry film thickness per coat.

F. Joint Sealant: Clear silicone sealant complying with Division 7 Section "Joint Sealants."

G. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

H. Adhesives: Type recommended by manufacturer for substrate and project conditions, and formulated to withstand minimum 60-lbf/sq. ft. wind-uplift force.

2.8 ALUMINUM FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

C. Finish manufactured roof specialties after fabrication and assembly if products are not fabricated from prefinished metals.

D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

E. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

F. High-Performance Organic Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating or resin manufacturer's written instructions.
   1. Fluoropolymer 2-Coat Coating System: Manufacturer's standard 2-coat, thermocured system composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 1402, Test Method 7.
      a. Color and Gloss: As selected by Architect from manufacturer's full range of colors and glosses.

2.9 COIL-COATED GALVANIZED STEEL SHEET FINISHES

A. General: Apply high-performance fluoropolymer coating, complying with ASTM A 755 process, in thickness indicated, on galvanized steel sheet as recommended by coating manufacturer and applicator. Furnish appropriate air-drying spray finish in matching color for touchup.

B. Fluoropolymer 2-Coat Coating System: Manufacturer's standard 2-coat, thermocured system composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; with a total minimum dry film thickness of 0.9 mil and 30 percent reflective gloss when tested according to ASTM D 523.
   1. Durability: Provide coating field tested under normal range of weather conditions for a minimum of 20 years without significant peel, blister, flake, chip, crack, or check in

finish; without chalking in excess of a chalk rating of 8 according to ASTM D 4214; and without fading in excess of 5 Hunter units.

2. Color and Gloss: As selected by Architect from manufacturer's full range of colors and glosses.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, roof edges, and parapets for suitable conditions for roof edge system installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Promptly remove protective film, if any, from exposed surfaces of finished metals. Strip with care to avoid damage to finish.

B. Prepare concrete, concrete masonry, and similar surfaces to receive roof edge system specified. Install blocking, cleats, water dams, and other anchoring and attachment accessories and devices required.

3.3 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Coordinate with installation of roof deck and other substrates to receive work of this Section and with vapor retarders, roofing insulation, roofing membrane, flashing, and wall construction, as required to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight. Anchor products securely to structural substrates to withstand lateral and thermal stresses and inward and outward loading pressures.

B. Isolation: Where metal surfaces of units contact dissimilar metal or corrosive substrates, including wood, apply bituminous coating on concealed metal surfaces or provide other permanent separation as recommended by aluminum producer.

C. Expansion Provisions: Install running lengths to allow controlled expansion for movement of metal components in relation to one another and to adjoining dissimilar materials, including flashing and roofing membrane materials, in a manner sufficient to prevent water leakage, deformation, or damage.

1. Space movement joints at not more than 10 feet apart, with no joints located within 24 inches of corner or intersection. Provide expansion joints with concealed, self-draining splice plate.

D. ROOF-EDGE FLASHING INSTALLATION
   1. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.
   2. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

E. COPING INSTALLATION
   1. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.
   2. Anchor copings to meet performance requirements.
      a. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at manufacturer's required spacing that meets performance requirements.
      b. Interlock face leg drip edge into continuous cleat anchored to substrate at manufacturer's required spacing that meets performance requirements. Anchor back leg of coping with screw fasteners and elastomeric washers at manufacturer's required spacing that meets performance requirements.

F. Roof Expansion Assemblies: Extend roof expansion joint assemblies over curbs, parapets, fasciae and other elements in the construction profile, with factory-fabricated transitions to provide continuous, uninterrupted, waterproof roof expansion assemblies.
   1. Install factory-fabricated transitions between roof expansion joint assemblies and building expansion joint cover assemblies, specified in Division 5 Section "Architectural Joint Systems," to provide continuous, uninterrupted, watertight construction.
   2. Splice roof expansion joint assemblies with materials provided by roof expansion assembly manufacturer for this purpose, according to manufacturer's written instructions, to provide continuous, uninterrupted, waterproof roof expansion assemblies.
   3. Provide uniform profile of expansion joint assembly throughout length of each installation; do not stretch polymeric sheets.
   4. Install mineral-fiber blanket insulation to fill joint space within joint and moisture barrier.
   5. Delete or revise three paragraphs below to suit Project.
   6. Bed anchorage flanges in cement or sealant recommended by manufacturer and securely nail to curbs and cant strips as recommended by manufacturer, but not less than 6 inches o.c.
   7. Anchor roof expansion joint assemblies in the manner indicated, complying with manufacturer's written instructions.
   8. Install roof expansion joint assemblies in the manner indicated, complying with manufacturer's instructions. Anchor to cants or curbs and seal to membrane with sealant compatible with roofing membrane and expansion joint assembly. Cover flanges with stripping or flashing and install according to requirements of roofing system manufacturer.

3.4 CLEANING AND PROTECTING

A. Clean exposed metal surfaces according to manufacturer's written instructions. Touch up damaged metal coatings.

B. Protection: Provide protective measures as required to ensure work of this Section will be without damage or deterioration at the time of Substantial Completion.

END OF SECTION 07.7100

SECTION 07.7200 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. Related Requirements:

1.2 SUMMARY

A. This Section includes the following:

1. Roof hatches
2. Safety Rail System
3. Roof access ladders

B. Related Sections include the following:

1. Division 06 Section "Rough Carpentry" for roof sheathing, wood cants, and wood nailers.
2. Division 07 Section "Sheet Metal Flashing and Trim" for shop- and field-fabricated metal flashing and counterflashing, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.

1.3 SUBMITTALS

A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details for roof accessories. Show layouts of roof accessories including plans and elevations. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components.

C. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing, and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Roof hatch design is based on products manufactured by The Bilco Company, New Haven, CT.

B. Provide products of this manufacturer or equal products of Babcock-Davis; or Milcor Inc.; or Nystrom, Inc.; or alternatives of the quality necessary to meet the specifications.

2.2 ROOF HATCH

A. Provide where indicated on plans metal roof hatch Type E, size width: 36" x length: 42". Length denotes hinge side. The roof hatch shall be single leaf. The roof hatch shall be pre-assembled from the manufacturer.

B. Performance characteristics:
1. Cover shall be reinforced to support a minimum live load of 40 psf with a maximum deflection of 1/150th of the span or 20 psf wind uplift.

2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
3. Operation of the cover shall not be affected by temperature.
4. Entire hatch shall be weather tight with fully welded corner joints on cover and curb.

C. Cover: Shall be 11 gauge paint bond G-90 galvanized steel with a 3" beaded flange with formed reinforcing members. Cover shall have a heavy extruded EPDM rubber gasket that is bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.

D. Cover insulation: Shall be fiberglass of 1" thickness, fully covered and protected by a metal liner 18 gauge aluminum.

E. Curb: Shall be 12" in height and of 14 gauge paint bond G-90 galvanized steel. The curb shall be formed with a 3-1/2" flange with 7/16" holes provided for securing to the roof deck. The curb shall be equipped with an integral metal capflashing of the same gauge and material as the curb, fully welded at the corners, that features the Bil-Clip® flashing system, including stamped tabs, 6" on center, to be bent inward to hold single ply roofing membrane securely in place.

F. Curb insulation: Shall be rigid, high-density fiberboard of 1" thickness on outside of curb.

G. Lifting mechanisms: Manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe for steel construction: through bolted to the curb assembly.

H. Hardware
1. Heavy pintle hinges shall be provided
2. Cover shall be equipped with a spring latch with interior and exterior turn handles.
3. Roof hatch shall be equipped with interior and exterior padlock hasps.
4. The latch strike shall be a stamped component bolted to the curb assembly.
5. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1" diameter red vinyl grip handle to permit easy release for closing.
6. Compression spring tubes shall be an anti-corrosive composite material and all other hardware shall be zinc plated and chromate sealed.
7. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.

I. Finishes: Factory finish shall be alkyd based red oxide primed steel.

2.3 HATCH RAIL SYSTEM

A. Furnish and install where indicated on plans hatch rail system Model RL2-E. The hatch rail system shall be field assembled and installed per the manufacturer's instructions.

B. Performance characteristics:
1. High visibility safety yellow powder coat paint finish.
2. Hatch rail system shall attach to the cap flashing of the roof hatch and shall not penetrate any roofing material.
3. Hatch rail system shall satisfy the requirements of OSHA 29 CFR 1910.23 and shall meet OSHA strength requirements with a factor of safety of two.
4. Corrosion resistant construction with a five-year warranty.
5. Hinged gate shall ensure continuous barrier around the roof hatch.
6. Self-closing gate hinge and positive latching system provided with hatch rail system.

C. Posts and Rails: 1-1/4" 6061 T6 schedule 40 aluminum pipe

D. Hardware: Mounting brackets shall be 3/8" thick extruded aluminum. Pivoting post guides with compression fittings and latching mechanism shall be cast aluminum. Self-closing hinges and all fasteners shall be type 316 stainless steel.

2.4 ROOF LADDERS

A. Fixed Ladder Design:
1. Landing platforms are required at 30 feet above the bottom of the ladder.
2. Rail and harness fall arrest system and landing platforms shall be provided on ladders over 24 feet in height.
    a. Rail and Harness Fall Arrest System: Provide manufacturer's Fall Arrest System in accordance with OSHA regulation 1910.27; permanently mounted to ladder rungs and complete with all necessary components.
    b. Fixed Ladder Bottom Bracket:
    c. Bottom floor supported bracket. (Interior)
    d. Bottom wall supported bracket. (Exterior).

B. Manufacturer
1. Roof access ladder design is based on products manufactured by O'Keeffe's Inc
2. Provide products of this manufacturer or equal products of; Alaco Ladder Company, Royalite Manufacturing, Inc. or alternatives of the quality necessary to meet the specifications.

    a. Fixed Access Ladder:
        1) Tubular Rail Low Parapet Access Ladder with Roofover Rail Extension .(mechanical and 2nd floor lobby roof)

a) Model 502 as manufactured by O'Keeffe's Inc.

b. Access Ladder (interior)

1) Standard Duty Channel Rail

a) Model 500 as manufactured by O'Keeffe's Inc.

C. Finish and Materials

1. Mill finish. As extruded.
2. Clear Anodic Finish: AA-M10C22A41 Mechanical finish as fabricated. Architectural Class I, clear coating 0.018 mm or thicker.
3. Aluminum Sheet: Alloy 5005-H34 to comply with ASTM B209.
4. Aluminum Extrusions: Alloy 6063-T6 to comply with ASTM B221.

D. Roof Ladder Warranty

1. Manufacturer has responsibility for an extended Corrective Period for work of this Section for a period of 5 years commencing on the shipment date of the product against all the conditions indicated below, and when notified in writing from Owner, manufacturer shall promptly and without inconvenience and cost to Owner correct said deficiencies.
    a. Defects in materials and workmanship.
    b. Deterioration of material and surface performance below minimum OSHA standards as certified by independent third party testing laboratory. Ordinary wear and tear, unusual abuse or neglect excepted.
    c. Within the warranty period, the manufacturer shall, at its option, repair, replace, or refund the purchase price of defective ladder.
2. Manufacturer shall be notified immediately of defective products and be given a reasonable opportunity to inspect the goods prior to return. Manufacturer will not assume responsibility, or compensation, for unauthorized repairs or labor. Manufacturer makes no other warranty, expressed or implied, to the merchantability, fitness for a particular purpose, design, sale, installation, or use, of the ladder; and shall not be liable for incidental or consequential damages, losses of or expenses, resulting from the use of ladder products

E. Roof Ladder Fabrication

1. Rungs: Not less than 1-1/4 inches (32 mm) in section and 18–3/8 inches (467mm) long, formed from tubular aluminum extrusions. Squared and deeply serrated on all sides.
2. Rungs shall withstand a 1,500 pound (454 kg) load without deformation or failure.
3. Channel Side Rails: Not less than 1/8 inch (3 mm) wall thickness by 3 inches (76 mm) wide.
4. Heavy Duty Tubular Side Rails: Assembled from two interlocking aluminum extrusions no less than 1/8 inch (3 mm) wall thickness by 3 inches (76 mm) wide. Construction shall be self-locking stainless steel fasteners, full penetration TIG welds and clean, smooth and burr-free surfaces.

5. Ship Ladders: Not less than 1-1/4 inches (32mm) high, 4-1/8 inch (105 mm) deep and 2 feet (610 mm) wide; tread spacing shall be 1 foot (305 mm) on center. Handrails shall be aluminum pipe, not less than 1-1/2 inches (38 mm) in diameter with hemispheric end caps.
6. Walk-Through Rail and Roof Rail Extension: Not less than 3 feet 6 inches (1067 mm) above the landing and shall be fitted with deeply serrated, square, tubular grab rails.
7. Landing Platform: 1-1/2 inches (38 mm) or greater diameter, tubular aluminum guardrails and decks of serrated aluminum treads.
8. Ship Ladder Seismic Bottom Support: Manufacturer's standard; two isolation bearings per stringer.
9. Ladder Safety Post: Retractable hand hold and tie off.

2.5 MISCELLANEOUS MATERIALS

A. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by roof accessory manufacturer. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.

B. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.

C. Elastomeric Sealant: ASTM C 920, polyurethane sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

D. Roofing Cement: ASTM D 4586, non-asbestos, fibrated asphalt cement designed for trowel application or other adhesive compatible with roofing system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.

1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored and is ready to receive roof accessories.
2. Verify dimensions of roof openings for roof accessories.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Install roof accessories to fit substrates and to result in watertight performance.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.

E. Roof Hatch Installation:

1. Check roof hatch for proper operation. Adjust operating mechanism as required. Clean and lubricate joints and hardware.
2. Attach safety railing system to roof hatch curb.

F. Seal joints with elastomeric sealant as required by manufacturer of roof accessories.

3.3 CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions.

END OF SECTION 07.7200

SECTION 07.7600 – ROOF PAVER & PEDESTAL SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary

A. Furnish and install a complete Architectural Pavers and Adjustable Pedestals deck support system with a maximum cavity height of up to 22 inches.

B. Related Sections include the following:
   1. Division 03 - Section 03.3000 Cast-in-Place Concrete.
   2. Division 06 - Section 06.1053 Miscellaneous Rough Carpentry.
   3. Division 07 - Section 07200 Roof Accessories.
   4. Division 07 – EPDM Single-Ply Roofing.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. ASTM D 638 - Tensile Properties of Plastics
   2. ASTM D 790 - Flexural Properties of Unreinforced and Reinforced Plastics Insulating
   3. ASTM D 1525 -Vicat Softening Temperature of Plastics

1.4 SUBMITTALS

A. Submit under provisions of Section 01.3000.

B. Samples:
   1. Architectural Pavers: Submit samples for type, color and texture required.
   2. Pedestals: Submit sample of each pedestal component.
   3. PVC Pipe: Submit 12-inch long sample of PVC pipe.

B. Shop Drawings: Submitted by contractor showing all components required for the paver & pedestal requirements. Shop drawings shall include plan drawings showing layout of all paver areas and detail drawings showing how the various components of the system fit together. Include manufacturer's literature completely describing all components of the paver pedestal systems and giving detailed installation recommendations and instructions. Also included detailed installation drawings for all precast pavers.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: All products covered under this Section shall be produced by a single manufacturer unless otherwise specified with a minimum of fifteen (15) years proven production experience.

B. Installer Qualifications: Installer shall have a minimum of three (3) years proven construction experience and be capable of estimating & building from blueprint plans and details, determining elevations, in addition to proper material handling. All Work must comply with Tile Tech Inc installation application procedures for pedestal mounted pavers as specified herein.

C. Special Consideration: The installer and or subcontractor must assume the responsibility for and take into consideration (1) the structural capability and adequacy of the structure to carry the dead and live load weight(s) involved, and (2) that the density of any insulation is satisfactory to resist crushing and damaging the waterproofing membrane.

1.6 DELIVERY, STORAGE, AND HANDLING

A. In accordance with provisions of Section 01300.

1 B. Protect Concrete Pavers and Pedestal System during shipment, storage and construction against damage. Store a minimum of 4 inches off the ground in a dry location and cover with polyethylene to protect from contact with materials which would cause staining or discoloration.

1.7 PROJECT CONDITIONS

A. Tile Tech Pedestal System specified are to be used with pedestrian traffic only & all four (4) sides of a deck system must restrain and contain the decking panels with perimeter blocking or walls. Decking panels must not be allowed to move laterally.

B. All membrane waterproofing and protection board surfaces to receive pedestals must be broom clean, frost free, and free of dirt, oil or any rough foreign matter, which may impair the waterproofing / roofing manufacturers guarantee or protection requirements.

C. The substrate that is to receive pedestals must have slope and provide positive and adequate drainage in accordance with good building practice and applicable building codes.

D. Decks over Roofing and Waterproofing;

1. If high density closed cell extruded 60psi polystyrene insulation is installed on top of the membrane in a protected membrane system, Tile Tech Pedestals may be installed directly on top of this type of insulation.
2. Do not use Tile Tech Pedestals over any insulation less than 60psi or with low density polystyrene (bead board) insulation.

F. Installation or anticipated installation of additional items on top of the deck such as planters, hot tubs, sculptures, or industrial equipment must be supported directly by additional pedestals that are in addition to the main deck paver/tile pedestal system. Failure to adequately support the additional weight of any such features or items may cause significant damage to the deck, underlying structure, or waterproofing .

1.8 WARRANTIES / GUARANTEES

A. Tile Tech Pedestal System (pavers and pedestals) shall remain free from defects for a period

of ten (10) years. The contractor shall warrant that his work will remain free from defects of labor and materials used in conjunction with his work in accordance with the general conditions for this project or a maximum of three (3) years.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. The Paver Pedestal Systems specified herein are based upon products manufactured by:
Tile Tech Inc., 888-380-5575 Phone: (213) 380-5560 Fax: (213) 380-5561
E-mail: sales@tiletechpavers.com Website: www.tiletechpavers.com

B. Paver Pedestal Systems equal in appearance and function and meeting these specifications, will be acceptable when the specified submittals are approved in writing by the Architect prior to bid.

2.2 MATERIALS

A. IPE WOOD DECK TILES:
1. Type: IPE Wood Deck Tiles.
2. Color: Natural State.
3. Size: Nominal: 24”x24”x1-5/8”
4. Finish: Smooth finished.
5. Weight: 6lb per Sqft.

B. PEDESTALS:
1. Stak-Cap™ Pedestals: PVC Pipe & Stack Adjustable
   a. Stack or use SDR35 PVC pipe to accommodate various HEIGHT adjustments of ½” to 2”.
   b. Each cap provides maximum of ½” of HEIGHT and 1% SLOPE. Rotate and stack one cap relative to another to accommodate SLOPE adjustments from 0% to 5%.
   c. Base diameter of 6-inch and top diameter of 5-¼-inch and is ½-inch high.
   d. Made of high impact and flame resistant ABS plastic.
   e. Use of Buffer Pads under Stak-Cap™ Pedestals is MANDATORY.

2. Uni-Just™ Pedestals: PVC Pipe & Screw Adjustable
   a. Assembly consist of 5 parts: Uni-Base™, Uni-Collar™, Uni-Insert™, Uni-Cap™ & Buffer Pads.
   b. Use SDR35 PVC pipe to accommodate various HEIGHT adjustments from 2-½” to 24”.
   Additional precise height adjustment of up to 1-½” with the use of Uni-Insert™

which can screw up or down while loaded. Additional heights beyond 24" can be accomplished subject to consultation with manufacturer and approval by manufacturer.

c. Self-leveling and can tilt in any direction to a level plane to accommodate SLOPE adjustments from 0% to 6%.

d. Base diameter of 7.25-inch with bearing surface area of thirty-eight (38) square inches.

e. Made of 100% recycled and flame-resistant High-Density Polypropylene.

f. Use of Buffer Pads under Uni-Just™ Pedestals is MANDATORY.

3. Uni-Shims™: 1/8-inch & 1/16-inch Thick

a. Can be used whole or broken into halves or quarters and can be stacked up to 2 high.

b. Used on top or under Stak-Cap™ or Uni-Just™ Pedestals for fine leveling of pedestals and or individual pavers.

c. Made of high impact and flame-resistant ABS plastic.

C. OTHER COMPONENTS:

1. Pedestal Pipe: 4-inch diameter SDR35 PVC Sewer Pipe

a. Used with either Stak-Cap™ or Uni-Just™ Pedestals and is cut to required height.

b. Dimensions: 4.215-inch outside diameter & 3.890-inch inside diameter.

c. Meet ASTM D-3034 and F-679.

b. NOT supplied with pedestal components by Tile Tech Inc.

2. Protection Course:

a. Protection board (required over insulated BUR systems, and when specified for use over bituminous asphalt-based waterproofing): W.R. Meadows "Vibraflex" or equal, minimum 3/8- inch thick asphaltic composition protection board.

b. Insulation (when specified): Dow Styrofoam "Highload 100" or equal, minimum compressive strength of 100psi recommended for foam plastic insulation placed beneath Pedestal System to prevent damage to the waterproofing membrane.

c. NOT supplied with pedestal components by Tile Tech Inc.

3. Decking Screw

a. 1-1/4" deck screw used to secure 4 corners of IPE Deck Tiles to pedestal system.

2.3 PERIMETER CONTAINMENT AND SUPPORT

A. The complete assembly of insulation, protection board, pedestals and pavers must be restrained at the perimeter of the deck area.

B. Perimeter parapet walls, concrete dividers or other perimeter restraint must be capable of

resisting lateral forces (including seismic and wind). Cumulative movement in excess of 1/8 inch will void the Tile Tech Inc Pedestal System warranty.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Prior to starting work inspect the substrate to ensure that it has been properly prepared to accept the Tile Tech Pedestal System. The substrate and or surface shall be clean and free of any projections and debris which may impair the performance of the pedestal and or the deck system. Verify all elevations, required pedestal heights and deck dimensions. Commencement of work shall imply acceptance of surfaces & deck conditions.

B. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

3.2 PREPARATION

A. The substrate surface that will receive the Pedestal System must be well compacted (on Grade) or structurally capable of carrying the dead and live loads anticipated.
   1. Insulation OVER the membrane: (Option 1) Insulation and/or protection board (if specified) must be applied over the waterproofing substrate and/or specified drainage mat. Install the system according to the membrane manufacturer's recommendations and specifications.
   2. Insulation UNDER membrane: (Option 2) Insulation required to be installed within a roofing system below deck supports must meet the roofing membrane manufacturers' specifications and must have a minimum core density of 60psi.
   3. Protection Board: (for asphalt type systems used over waterproofing) Full coverage 1/8-inch asphaltic composition protection board is recommended. When protection is specified only under the pedestal cut protection board pads to extend beyond the outside perimeter of the pedestal system base or buffer pad by a minimum of TWO (2) inch.
   4. Drainage Mat: (when desired or specified) Install drainage mat according to the manufacturers recommendations to avoid crushing.

3.3 INSTALLATION

A. Install in accordance with Tile Tech Inc. and other contributing manufacturer's instructions. Installation requirements vary for each individual project site. Decking paver or tile used, pattern, grid layout, starting point, and finished elevation should be shown on plan view shop drawings, which have been prepared and approved by the designer, installing contractor and/or owner.

B. GRID LAYOUT AND ELEVATIONS:
   1. Once the starting point and the finished elevation of the deck surface have been

determined, the “Top of Pedestal Elevation” (finished elevation less decking paver or tile thickness) is established and marked around the perimeter using a transit water level or laser leveling device.

2. Precise measurements should be taken and deck area should be accurately defined. Mark off and ‘square up’ all outside edges with control lines using "snapped" chalk lines. Mark two (2) lines that are perpendicular to each other across the deck area. Continue to mark a grid of lines in both directions marking the location of each pedestal. Use the control lines as references to periodically check and assure a square layout during installation.

3. Next, a pedestal must be placed where each measured grid line meets the perimeter. Remove two (2) spacer tabs in line with one another atop each pedestal system placed around the perimeter. Remove all four (4) spacer tabs at corners.

4. Adjust each pedestal height to the “Top of Pedestal Elevation” marked on the perimeter. Position the pedestal as close to the edge of the perimeter as possible, with the two remaining spacer tabs aligned with the grid line. Using the elevation marked on the perimeter, stretch a mason’s line along and slightly ahead of the second row of pedestals. A laser leveling device may also be used for this purpose.

5. On larger decks, it is recommended that Tile Tech Pedestal System be pre-assembled and pre-set to the proper elevation and placed in position prior to the installation of decking paver or tile.

6. As the pedestals located along the grid lines are loaded with pavers or tiles, fine vertical height adjustment can be made by inserting and rotating, from the top, a T-handle Hex Key in to the Uni-Insert™ of the Pedestal assembly. Clockwise rotation of the Uni-Insert™ will raise the bearing surface and the deck. Counter-clockwise rotation will lower the top bearing surface and deck.

7. Always maintain adequate thread engagement. Tile Tech Pedestal Uni-Insert™ contains a locking tab that will not allow the screw to extend past its maximum extension. Never use if the locking tab is broken. If the height required goes beyond the Uni-Insert™ limit re-cut PVC pipe to the correct height and re-assemble the pedestal using the correct size pipe.

8. Slight irregularities in decking paver or tile thickness can be compensated for by using one (1) to two (2) shim segments. Place on top of the pedestal, under the corner(s) of the decking paver or tile. Use no more than two (2) shims on top of the pedestal and always adhere quartered (1/4) wedges with construction adhesive.

9. Stak-Cap™ Pedestal can be used for limited and or fixed height requirements. Complete deck and grid layout as instructed above. Stack no more than five (5) fixed

height Stak-Cap™ Pedestals together and place in lieu of Uni-Just™ Pedestals where needed. Stak-Cap™ Pedestal can also be used with PVC pipe to reduce cost. Spacer tabs can be removed to accommodate perimeter and corner support locations.

C. SLOPE AND HEIGHT COMPENSATION:

1. Stak-Cap™ Pedestals can provide limited slope and height compensation to maintain a level decking surface over sloping substrates and is accomplished using a combination of the following:
   a. Rotate and stack one cap in relation to another to change slope and add height. Each cap will add ½-inch of height and provide 1% slope. Stack no more than 5 caps.
   b. Can also be used with PVC Pipe cut to required height of maximum of 6-inches.

2. Uni-Just™ Pedestals can provide both slope and height compensation to maintain a level decking surface over sloping substrates and is accomplished using a combination of the following:
   a. PVC Pipe cut to varying lengths to compensate for GENERAL height requirements.
   b. SCREW extension for PRECISE height adjustment.
   c. Self-Leveling cap that pivots and tilts in any direction for slope compensation from 0% to 6%.
   d. Additional slope adjustments is achieved by the use of the Base Slop Plates that provide 2% slope per plate and can be stacked to a maximum of 5 units to obtain 10% slope.

3. Tile Tech Pedestals are designed to be rotated for final precise adjustment when they are fully loaded. Pedestals should be leveled in each succeeding row as the installation proceeds. Final height adjustment or maintenance is easily made by simply using a T-handle Hex Key that allows you to adjust the pedestals without removing the pavers. T-handle Hex Key is inserted between the four paver corners to engage Uni-Insert™ portion and is adjusted clockwise or counter clockwise to level as needed.

4. Uni-Shims™ may be used in multiples, whole or quarters, and placed under the pedestal base or on top the pedestal cap to level pedestals. Use a small amount of construction adhesive to adhere sections of shims and/or whole shims to each other or to the pedestal. DO NOT use construction adhesive to adhere pedestal or shims to insulation, roofing or waterproofing membrane. Additional sections of shims may be used and should be available for regular maintenance.

3.4 PERIMETER CONTAINMENT

A. Any area of the pedestal deck that is not restrained by a parapet or foundation wall must be ‘boxed-in’ and contained. The deck panels will move if all sides are not adequately restrained. Perimeter framing and edging boards located at the outside of the deck perimeter must be

installed to provide restraint. No movement should be allowed at the perimeter of the deck system greater than one tab width.

3.5 FIELD QUALITY CONTROL

A. Inspect often during installation to assure that grid spacer lines are being maintained in a straight and consistent pattern and that deck pavers or tiles are level and not rocking. Unless otherwise specified in writing to allow for expansion, inspect to assure that all paver spacing between tiles and at perimeter walls does not exceed a tab width. Particular attention should be made to assure that all pedestrian entry or access points to the deck are level and that the deck surface tiles are not randomly raised or uneven creating a tripping or safety hazard.

Confirm that deck pedestal height excess of sixteen (16) inches have been braced in accordance with Tile Tech Inc written instructions.

3.6 ROUTINE MAINTENANCE AND CARE

A. The deck owner must perform routine maintenance of the deck. Check for rocking pavers and adjust using T-Handle Hex Key or shim immediately. Pedestals can settle and may have to be realigned. Failure to do so can cause a tripping hazard. Periodically check spacer tabs and immediately replace broken tabs to limit deck movement. Make sure the edge restraint stays intact and structurally sound.

B. Extra Materials: Deliver supply of maintenance materials to the owner. Furnish not less than 1 percent maintenance materials from same lot as materials installed, and enclosed in protective packaging with appropriate identifying labels.

END OF SECTION 07.7600

SECTION 07.8100 – SPRAY APPLIED FIREPROOFING (SFRM)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sprayed fire-resistive materials.
   a. Concealed.

B. Related Requirements:

1. Division 05, Section "Structural Steel" for surface conditions required for structural steel receiving SFRM.

2. Division 05, Section "Steel Decking" for surface conditions required for steel decking receiving SFRM.

3. Division 07 "Intumescent Fire Protection" for intumescent paints that are fire resistive.

4. Division 07 “Joint Firestopping”.

1.3 DEFINITIONS

A. SFRM: Sprayed fire-resistive materials.

B. Concealed: Fire-resistive materials applied to surfaces that are concealed from view behind other construction when the Work is completed.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

B. Review products, exposure conditions, design ratings, restrained and unrestrained conditions, densities, thicknesses, bond strengths, and other performance requirements.

1. Review surface conditions and preparations.

2. Review field quality-control testing procedures.

1.5 ACTION SUBMITTALS

A. Product Data: For each of the following:

1. Sprayed fire-resistive material.
2. Substrate primers.
3. Bonding agent.
4. Metal lath.
5. Reinforcing fabric.
6. Reinforcing mesh.
7. Sealer.
8. Topcoat.

B. Shop Drawings: Framing plans or schedules, or both, indicating the following:

1. Extent of fire protection for each construction and fire-resistance rating.

2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.

3. Minimum sprayed fire-resistive material thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.

4. Treatment of sprayed fire-resistive material after application.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

B. Product Certificates: For each type of sprayed fire-resistive material, signed by product manufacturer.

C. Evaluation Reports: For sprayed fire-resistive material, from ICC-ES.

D. Compatibility and Adhesion Test Reports: From SFRM manufacturer indicating the following:

1. Materials have been tested for bond with substrates.
2. Materials have been verified by SFRM manufacturer to be compatible with substrate primers and coatings.

3. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

E. Preconstruction Test Reports: For fire protection.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for proposed SFRM

G. Field quality- control test and special inspection reports.

H. Warranties: Special warranties specified in this Section

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by sprayed fire-resistive material manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements. A manufacturer's willingness to sell its SFRM to a Contractor or to an installer engaged by Contractor does not in itself confer qualification on the buyer.

B. Source Limitations: Obtain SFRM through one source from a single manufacturer.

C. SFRM Testing: By a qualified testing and inspecting agency engaged by Contractor or manufacturer to test for compliance with specified requirements for performance and test methods.

1. SFRMs are randomly selected for testing from bags bearing the applicable classification marking of UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

2. Testing is performed on specimens of SFRMs that comply with laboratory testing requirements specified in Part 2 and are otherwise identical to installed fire-resistive materials, including application of accelerant, sealers, topcoats, tamping, troweling, rolling, and water overspray, if any of these are used in final application.

D. Fire-Test-Response Characteristics: Provide SFRM with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify bags containing SFRM with appropriate markings of applicable testing and inspecting agency.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" acceptable to authorities having jurisdiction, for SFRM serving as direct-applied protection tested per ASTM E 119.

2. Surface-Burning Characteristics: ASTM E 84.

E. Provide products containing no detectable asbestos as determined according to the method specified in 40 CFR 763, Subpart E, Appendix E, Section 1, "Polarized Light Microscopy."

F. Mockups: Build mockups to verify selections made under Sample submittals, to set quality standards for materials and execution and for preconstruction testing.

1. Build mockup of each type of fire protection and different substrate as shown on Drawings.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on field mockups of fire protection.

B. Field Mockup: Architect shall determine 10' x 10' areas of the structure of different types of construction to be tested as follows:

1. Columns.

2. Beams and Floor Construction.

3. Roof Construction.

4. Other specific areas as determined by the Architect to require Spray Fire Resistive Material protection.

5. Provide test specimens and assemblies representative of proposed materials and construction.

C. Preconstruction Adhesion and Compatibility Testing: Test for compliance with requirements for specified performance and test methods.

1. Bond Strength: Test for cohesive and adhesive strength according to ASTM E736. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.

2. Density: Test for density according to ASTM E605. Provide density indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.

3. Verify that manufacturer, through its own laboratory testing or field experience, attests that primers or coatings are compatible with sprayed fire-resistive material.

4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.

5. For materials failing tests, obtain sprayed fire-resistive material manufacturer's written instructions for corrective measures including the use of specially formulated bonding agents or primers.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not apply fire protection when ambient or substrate temperature is 44 deg F (7 deg C) or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of fire protection, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fire protection dries thoroughly.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Assemblies: Provide fire protection, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.

B. Source Limitations: Obtain fire protection for each fire-resistance design from single source.

C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings from an applicable testing agency.

1. Steel members are to be considered unrestrained unless specifically noted otherwise.

D. Asbestos: Provide products containing no detectable asbestos.

2.2 SPRAYED FIRE-RESISTIVE MATERIALS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
1. Concealed Cementitious SFRM:

a. Isolatek International Corp.; Cafco Blaze-Shield II.
b. Grace, W. R. & Co. - Conn., Construction Products Div.; Monokote Type MK-6/HY.
c. Southwest Vermiculite Co., Inc.; Type 5.

B. Material Composition: Manufacturer's standard product, as follows:

1. Concealed Cementitious SFRM: Factory-mixed, dry formulation of gypsum or Portland cement binders, additives, and lightweight mineral or synthetic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application.

C. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property as follows:

1. Dry Density: 15 lb./cu. ft. (240 kg/cu. m) for average and individual densities, or greater if required to attain fire-resistance ratings indicated, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."
2. Thickness: Minimum average thickness required for fire-resistance design indicated according to the following criteria, but not less than 0.375 inch (9 mm), per ASTM E 605:

a. Where the referenced fire-resistance design lists a thickness of 1 inch (25 mm) or more, the minimum allowable individual thickness of SFRM is the design thickness minus 0.25 inch (6 mm).

b. Where the referenced fire-resistance design lists a thickness of less than 1 inch (25 mm) but more than 0.375 inch (9 mm), the minimum allowable individual thickness of SFRM is the greater of 0.375 inch (9 mm) or 75 percent of the design thickness.

c. No reduction in average thickness is permitted for those fire-resistance designs whose fire-resistance ratings were established at densities of less than 15 lb./cu. ft. (240 kg/cu. m).

3. Bond Strength: 150 lbf./sq. ft. (7.2 kPa) minimum per ASTM E 736 based on laboratory testing of 0.75-inch (19-mm) minimum thickness of SFRM.

4. Compressive Strength: 1,440 psf. (68.9 kPa) minimum per ASTM E 761. Minimum thickness of SFRM tested shall be 0.75 inch (19 mm) and minimum dry density shall be as specified but not less than 15 lb./cu. ft. (240 kg/cu. m).

5. Corrosion Resistance: No evidence of corrosion per ASTM E 937.

6. Deflection: No cracking, spalling, or delamination per ASTM E 759.

7. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E 760.

8. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. (0.270 g/sq. m) in 24 hours per ASTM E 859. For laboratory tests, minimum thickness of SFRM is 0.75 inch (19 mm), maximum dry density is 15 lb./cu. ft. (240 kg/cu. m), test specimens are not prepurged by mechanically induced air velocities, and tests are terminated after 24 hours.

9. Fire-Test-Response Characteristics: Provide SFRM with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

    a. Flame-Spread Index: 0.
    b. Smoke-Developed Index: 0.

10. Fungal Resistance: No observed growth after 28 days on specimens per ASTM G 21.

2.3 AUXILIARY MATERIALS

A. Provide auxiliary materials that are compatible with sprayed fire-resistive material and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: Primers approved by sprayed fire-resistive material manufacturer and complying with one or both of the following requirements:

1. Primer and substrate are identical to those tested in required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

2. Primer's bond strength in required fire-resistance design complies with specified bond strength for sprayed fire-resistive material and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests according to ASTM E736.

C. Bonding Agent: Product approved by sprayed fire-resistive material manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.

D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required, according to fire-resistance designs indicated and sprayed fire-resistive material manufacturer's written instructions. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive sprayed fire-resistive material.

E. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by sprayed fire-resistive material manufacturer.

F. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by sprayed fire-resistive material manufacturer. Include pins and attachment.

G. Sealer for Sprayed-Fiber Fire-Resistive Material: Transparent-drying, water-dispersible, tinted protective coating recommended in writing by manufacturer of sprayed-fiber fire-resistive material.

1. Product: Subject to compliance with requirements, provide "Cafco Bond-Seal" by Isolatek International Corp.

H. Topcoat: Suitable for application over sprayed fire-resistive material; of type recommended in writing by sprayed fire-resistive material manufacturer for each fire-resistance design.

1. Cement-Based Topcoat: Manufacturer's recommended factory-mixed, cementitious hard-coat formulation for trowel or spray application over SFRM.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design.

1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fire protection with substrates under conditions of normal use or fire exposure.

2. Verify that objects penetrating fire protection, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.

3. Verify that substrates receiving fire protection are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fire protection application.

B. Verify that concrete work on steel deck is complete before beginning Work.

C. Verify that roof construction, installation of rooftop HVAC equipment, and other related work are complete before beginning Work.

D. Conduct tests according to sprayed fire-resistive material manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.

E. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fire protection materials during application.

B. Clean substrates of substances that could impair bond of fire protection.

C. Prime substrates where included in fire-resistance design and where recommended in writing by sprayed fire-resistive material manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fire protection.

D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fire protection. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

A. Construct fire protection assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fire protection Work.

B. Comply with sprayed fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fire protection; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fire protection with other construction to minimize need to cut or remove fire protection.

1. Do not begin applying fire protection until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.

2. Defer installing ducts, piping, and other items that would interfere with applying fire protection until application of fire protection is completed.

D. Metal Decks:

1. Do not apply fire protection to underside of metal deck substrates until concrete topping, if any, is completed.
2. Do not apply fire protection to underside of metal roof deck until roofing is completed; prohibit roof traffic during application and drying of fire protection.

E. Install auxiliary materials as required, as detailed, and according to fire-resistance design and sprayed fire-resistive material manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by sprayed fire-resistive material manufacturer.

F. Spray apply fire protection to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by sprayed fire-resistive material manufacturer.

G. Extend fire protection in full thickness over entire area of each substrate to be protected.

H. Install body of fire protection in a single course unless otherwise recommended in writing by sprayed fire-resistive material manufacturer.

I. Retain first paragraph below if applicable for abatement of asbestos or other hazardous material.

J. For applications over encapsulant materials, including lockdown (post-removal) encapsulants, apply fire protection that differs in color from that of encapsulant over which it is applied.

K. Where sealers are used, apply products that are tinted to differentiate them from fire protection over which they are applied.

L. Provide a uniform finish complying with description indicated for each type of fire protection material and matching finish approved for required mockups.

M. Cure fire protection according to sprayed fire-resistive material manufacturer's written instructions.

N. Do not install enclosing or concealing construction until after fire protection has been applied, inspected, and tested and corrections have been made to deficient applications.

O. Finishes: Where indicated, apply fire protection to produce the following finishes:

1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.

2. Spray-Textured Finish: Finish left as spray applied with no further treatment.

3. Rolled, Spray-Textured Finish: Even finish produced by rolling spray-applied finish with a damp paint roller to remove drippings and excessive roughness.

4. Skip-Troweled Finish: Even leveled surface produced by troweling spray-applied finish to smooth out the texture and neaten edges.

5. "Skip-Troweled Finish with Corner Beads" Subparagraph below requires installation of screeds or corner beads.

6. Skip-Troweled Finish with Corner Beads: Even, leveled surface produced by troweling spray-applied finish to smooth out the texture, eliminate surface markings, and square off edges.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspection and prepare reports:

1. SFRM.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

C. Tests and Inspections: Testing and inspecting of completed applications of SFRM shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with application of SFRM for the next area until test results for previously completed applications of SFRM show compliance with requirements. Tested values must equal or exceed values indicated and required for approved fire-resistance design.

1. Thickness for Floor, Roof, and Wall Assemblies: For each 1000-sq. ft. (93-sq. m) area, or partial area, on each floor, from the average of 4 measurements from a 144-sq. in. (0.093-sq. m) sample area, with sample width of not less than 6 inches (152 mm) per ASTM E 605.

2. Thickness for Structural Frame Members: From a sample of 25 percent of structural members per floor, taking 9 measurements at a single cross section for structural frame beams or girders, 7 measurements of a single cross section for joists and trusses, and 12 measurements of a single cross section for columns per ASTM E 605.

3. Density for Floors, Roofs, Walls, and Structural Frame Members: At frequency and from sample size indicated for determining thickness of each type of construction and structural framing member, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."

4. Bond Strength for Floors, Roofs, Walls, and Structural Framing Members: For each 10,000 sq. ft. (929 sq. m) area, or partial area, on each floor, cohesion and adhesion from one sample of size indicated for determining thickness of each type of construction and structural framing member, per ASTM E 736.

    a. Field test SFRM that is applied to flanges of wide-flange, structural-steel members on surfaces matching those that will exist for remainder of steel receiving fire-resistive material.
    b. If surfaces of structural steel receiving SFRM are primed or otherwise painted for coating materials, perform series of bond tests specified in UL's "Fire Resistance Directory." Provide bond strength indicated in referenced UL fire-resistance criteria, but not less than 150 lbf./sq. ft. (7.2 kPa) minimum per ASTM E 736.

5. If testing finds applications of SFRM are not in compliance with requirements, testing and inspecting agency will perform additional random testing to determine extent of noncompliance.

D. Remove and replace applications of SFRM that do not pass tests and inspections for cohesion and adhesion, for density, or for both and retest as specified above.

E. Apply additional SFRM, per manufacturer's written instructions, where test results indicate that thickness does not comply with specified requirements, and retest as specified above.

3.5 CLEANING

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

3.6 PROTECTION

A. Protect fire protection, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fire protection is without damage or deterioration at time of Substantial Completion.

3.7 REPAIRS

A. As installation of other construction proceeds, inspect fire protection and repair damaged areas and fire protection removed due to work of other trades.

B. Repair fire protection damaged by other work before concealing it with other construction.

C. Repair fire protection by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 07.8100

SECTION 07.8123 - INTUMESCENT FIRE PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes mastic and intumescent fire-resistive coatings.

B. Related Requirements:
1. Section 05.1200 “Structural Steel Framing”.
2. Section 05.1213 “Architecturally Exposed Structural Steel”.
3. Section 05.2100 “Steel Joist”.
4. Section 05.3100 “Steel Deck”.
5. Section 078100 "Applied Fireproofing" for sprayed fire-resistive materials (SFRM).

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review products, design ratings, restrained and unrestrained conditions, thicknesses, and other performance requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Framing plans or schedules, or both, indicating the following:

1. Extent of fireproofing for each construction and fire-resistance rating.

2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.

3. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.

4. Treatment of fireproofing after application.

C. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard dimensions in size.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of fireproofing.

C. Evaluation Reports: For fireproofing, from ICC-ES.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

B. Mockups: Build mockups to set quality standards for materials and execution.

1. Build mockup of each type of fireproofing and different substrate.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is **50 deg F (10 deg C)** or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.

B. Source Limitations: Obtain fireproofing for each fire-resistance design from single source.

C. Fire-Resistance Design: Indicated on Drawings, tested according to UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Steel members are to be considered unrestrained unless specifically noted otherwise.

D. Asbestos: Provide products containing no detectable asbestos.

2.2 MASTIC AND INTUMESCENT FIRE-RESISTIVE COATINGS

A. Mastic and Intumescent Fire-Resistive Coating Design No. X674: Manufacturer's standard, factory-mixed formulation, and complying with indicated fire-resistance design.

1. Basis of Design Product and Manufacturer:
   a. Interchar 212, by International

2. Subject to compliance with requirements, the following are acceptable manufacturers:
   a. Isolatek

3. Application: Designated for "interior general purpose" use by a qualified testing agency acceptable to authorities having jurisdiction.

4. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design.

5. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

   a. Flame-Spread Index: 25 or less.
   b. Smoke-Developed Index: 50 or less.

6. Hardness: Not less than 65, Type D durometer, according to ASTM D 2240.

7. Finish: As selected by Architect from manufacturer's standard finishes.

a. Color and Gloss: As indicated by manufacturer's designations

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

C. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.

D. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.

E. Primer and Topcoat: Manufacturers recommended products suitable for application over applied fireproofing of type recommended in writing by fireproofing manufacturer for each fire-resistance design.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design.

1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.

2. Verify that objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.

3. Verify that substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.

B. Conduct tests according to fireproofing manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.

B. Clean substrates of substances that could impair bond of fireproofing.

C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.

D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, topcoats, finishing, and other materials and procedures affecting fireproofing work.

B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.

1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.

2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.

D. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.

E. Spray apply fireproofing to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.

F. Extend fireproofing in full thickness over entire area of each substrate to be protected.

G. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.

H. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.

I. Cure fireproofing according to fireproofing manufacturer's written instructions.

J. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.

K. Finishes: Where indicated, apply fireproofing to produce the following finishes:

1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.

2. Spray-Textured Finish: Finish left as spray applied with no further treatment.

3. Rolled, Spray-Textured Finish: Even finish produced by rolling spray-applied finish with a damp paint roller to remove drippings and excessive roughness.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Test and inspect as required by the IBC, Subsection 1705.14, "Mastic and Intumescent Fire-Resistant Coatings."

B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

C. Fireproofing will be considered defective if it does not pass tests and inspections.

1. Remove and replace fireproofing that does not pass tests and inspections, and retest.

2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

D. Prepare test and inspection reports.

3.5 CLEANING, PROTECTING, AND REPAIRING

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing is without damage or deterioration at time of Substantial Completion.

C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.

D. Repair fireproofing damaged by other work before concealing it with other construction.

E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 07.8123

SECTION 07.8413 – FIRE STOPPING AND SMOKE STOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes through-penetration firestopping systems for all interruptions and penetrations through the following fire-resistance-rated assemblies, including both empty openings and openings containing penetrating items:
   1. Penetrations in fire-resistance-rated walls.
   2. Penetrations in horizontal assemblies.
   3. Penetrations in smoke barriers.
   4. Joints at exterior curtain-wall/floor intersections.

B. This Section includes fire blocking for all interruptions and penetrations through non-fire-resistance-rated floor assemblies.

C. Related Sections include the following:
   1. Division 07 Section "Fire-Resistive Joint Systems."
   2. Division 22 and 23 Sections: Duct and piping penetrations.
   3. Division 25-28 Sections: Cable and conduit penetrations.

1.2 PERFORMANCE REQUIREMENTS

A. General: Provide firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated.

B. F-Rated Systems: Provide firestopping with F-ratings indicated, as determined per ASTM E 814, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

C. T-Rated Systems: For the following conditions, provide firestopping with T-ratings indicated, as well as F-ratings, as determined per ASTM E 814, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
   1. Penetrations located outside wall cavities.
   2. Penetrations located outside fire-resistive shaft enclosures.
   3. Penetrations located in construction containing fire-protection-rated openings.
   4. Penetrating items larger than 4-inch-diameter nominal pipe or 16 sq. in. in overall cross-sectional area.

D. Fire Blocking: Fill penetrations in non-fire-resistance-rated floor construction with non-combustible material tested for resistance to passage of fire, smoke and heat, as acceptable to authorities having jurisdiction and complying with 2009 IBC, Section 717.1 et.al.
   1. Provide fire blocking using systems rated for not less than 1 hour fire-resistance rating.

E. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.
   1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant firestopping.
   2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved either by installing floor plates or by other means.
   3. For penetrations involving insulated piping, provide firestopping not requiring removal of insulation.

F. For firestopping exposed to view, provide products with flame-spread ratings of less than 25 and smoke-developed ratings of less than 450, as determined per ASTM E 84.

1.3 SUBMITTALS

A. Product Data: For each type of through-penetration firestop system product indicated.

B. Shop Drawings: For each through-penetration firestop system, show each kind of construction condition penetrated, relationships to adjoining construction, and kind of penetrating item. Include firestop design designation of testing and inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition indicated.
   1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
   2. Engineering Judgement: Where Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer.

C. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

D. Product Certificates: Signed by manufacturers of through-penetration firestop system products certifying that products furnished comply with requirements.

E. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

1.4 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed firestopping similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
   1. A firm that has been approved by FM Approval according to FM Approval 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

B. Source Limitations: Obtain firestopping, for each kind of penetration and construction condition indicated, from a single manufacturer, and from the same manufacturer as for fire-resistive joint systems specified in Division 07 Section "Fire-Resistive Joint Systems."
   1. Manufacturer selection is the responsibility of the Fire Protection Contractor as determined in the Summary of Work. Other Contractors shall comply with specified requirements using products of manufacturer selected.

C. Fire-Test-Response Characteristics: Provide firestopping that comply with the following requirements and those specified in "Performance Requirements" Article:
   1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
   2. Firestopping systems are identical to those tested per ASTM E 814. Provide rated systems complying with the following requirements:
      a. Firestopping products bear classification marking of qualified testing and inspecting agency.
      b. Firestopping products correspond to those indicated by reference to through-penetration firestop system designations listed by UL in "Fire Resistance Directory."

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.6 PRODUCT HANDLING

A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and

manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.

B. Store and handle materials for firestopping to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install firestopping when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate firestopping per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that firestopping is installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate firestopping.

C. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until building inspector, if required by authorities having jurisdiction, have examined each installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:
   1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
      a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
         1) UL in its "Fire Resistance Directory."
         2) Intertek Group in its "Directory of Listed Building Products."
         3) FM Approval in its "Approval Guide."

2.2 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. 3M Fire Protection Products.
      b. Hilti, Inc.
      c. Tremco, Inc.

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
   1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
   1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
   2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg.
   1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at and no more than 50-cfm cumulative total for any 100 sq. ft. at both ambient and elevated temperatures.

E. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated. Accessories include, but are not limited to, the following items:
   1. Permanent forming/damming/backing materials, including the following:
      a. Slag-/rock-wool-fiber insulation.
      b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
   2. Fire-rated form board.
   3. Fillers for sealants.
   4. Temporary forming materials.
   5. Substrate primers.
   6. Collars.

7. Steel sleeves.

2.3 FILL MATERIALS FOR FIRESTOPPING SYSTEMS

A. General: Provide firestopping containing the types of fill materials indicated in the Through-Penetration Firestop System Schedule at the end of Part 3 by reference to the types of materials described in this Article. Fill materials are those referred to in directories of the referenced testing and inspecting agencies as fill, void, or cavity materials.

B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.

D. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

E. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.

F. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

G. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

H. Mortars: Prepackaged, dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

I. Pillows/Bags: Reusable, heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.

J. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

K. Silicone Sealants: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
   1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces and nonsag formulation for openings in vertical and other surfaces requiring a

nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.

2. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.
3. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.

2.4 MIXING

A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing firestopping to comply with written recommendations of firestop system manufacturer and the following requirements:
   1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of firestopping.
   2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from

firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

A. General: Install firestopping to comply with "Performance Requirements" Article and firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for firestop systems by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
   2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.
   1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.

B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing and inspecting agency.
   4. Date of installation.
   5. Manufacturer's name.

6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E2174.

B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to produce firestopping complying with specified requirements.

END OF SECTION 07.8413

SECTION 07.9200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:

1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Urethane joint sealants.
4. Immersible joint sealants.
5. Mildew-resistant joint sealants.
6. Latex joint sealants.

B. Related Sections include the following:

1. Division 04 Section "Unit Masonry": Masonry control and expansion joint fillers and gaskets.
2. Division 07 Section "Composite Metal Panels": Sealing joints in metal fascia panels.
3. Division 07 Section "Metal Flashing and Trim": Sealing joints related to flashing and sheet metal; including sealant products for concealed joints in sheet metal assemblies.
4. Division 07 Section "Fire-Resistive Joint Systems": Sealing joints in fire-resistance-rated construction.
5. Division 08 Section "Glazing": Glazing sealants.
6. Division 09 Section "Gypsum Board Assemblies": Sealing perimeter joints of gypsum board partitions to reduce sound transmission.
7. Division 09 Section "Acoustical Ceilings": Sealing edge moldings at perimeters of acoustical ceilings.

1.2 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.3

1.4 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Product Certificates: Signed by manufacturers of joint sealants certifying that products furnished comply with requirements and are suitable for the use indicated.

D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Preconstruction Field Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on preconstruction testing specified in "Quality Assurance" Article.

F. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Preconstruction Compatibility and Adhesion Testing: Submit to joint sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use manufacturers standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit not fewer than nine pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.

5. Testing will not be required if joint sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

D. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to joint substrates as follows:
   1. Locate test joints where indicated or, if not indicated, as directed by Architect.
   2. Conduct field tests for each type of sealant and joint substrate indicated.
   3. Notify Architect seven days in advance of dates and times when test joints will be erected.
   4. Arrange for tests to take place with joint sealant manufacturer's technical representative present.
   5. Test Method: Test joint sealants by hand-pull method described below:

      a. Install joint sealants in 60-inch-long joints using same materials and methods for joint preparation and joint-sealant installation required for the completed Work. Allow sealants to cure fully before testing.
      b. Make knife cuts from one side of joint to the other, followed by two cuts approximately 2 inches long at sides of joint and meeting cross cut at one end. Place a mark 1 inch from cross-cut end of 2-inch piece.
      c. Use fingers to grasp 2-inch piece of sealant between cross-cut end and 1-inch mark; pull firmly at a 90-degree angle or more in direction of side cuts while holding a ruler alongside of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.
      d. For joints with dissimilar substrates, check adhesion to each substrate separately. Do this by extending cut along one side, checking adhesion to opposite side, and then repeating this procedure for opposite side.

   6. Report whether sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
   7. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.6 PRODUCT HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.

B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.8 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Installer's Warranty: Written warranty, signed by Installer agreeing to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:

1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.

2. Mechanical damage caused by individuals, tools, or other outside agents.

D. Provide material warranties for each type of sealant as follows:

1. Latex Sealants: 5 year material warranty from date of Substantial Completion.
2. Urethane Sealants: 10 year material warranty from date of Substantial Completion.
3. Silicone Sealants: 20 year material warranty from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.

1. Manufacturers: Subject to compliance with requirements, undefined:

a. Adfast.
b. GE Construction Sealants; Momentive Performance Materials Inc.
c. Sika Corporation; Joint Sealants.

2.3 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested in accordance with ASTM C1248.

B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Pecora Corporation.

b. Sika Corporation; Joint Sealants.
c. Tremco Incorporated.

2.4 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Pecora Corporation.
b. Sika Corporation; Joint Sealants.
c. Tremco Incorporated.

2.5 IMMERSIBLE JOINT SEALANTS

A. Immersible Joint Sealants. Suitable for immersion in liquids; ASTM C1247, Class 1 ; tested in deionized water unless otherwise indicated

B. Urethane, Immersible, S, NS, 100/50, NT, I: Immersible, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses NT and I.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Tremco Incorporated.

2.6 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Pecora Corporation.

b. The Dow Chemical Company.
c. Tremco Incorporated.

2.7 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Pecora Corporation.
   b. Sherwin-Williams Company (The).
   c. Tremco Incorporated.

2.8 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Adfast.
   b. Alcot Plastics Ltd.
   c. Construction Foam Products; a division of Nomaco, Inc.

B. Cylindrical Sealant Backings: ASTM C1330, [Type C (closed-cell material with a surface skin)] [Type O (open-cell material)] [Type B (bicellular material with a surface skin)] [or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated], and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.9 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Preparing Existing Joints: Completely remove existing sealant, backing materials and other joint fillers from joints in existing building in areas indicated. / all exterior and interior joints within Contract limits.

B. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.

4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

C. Joint Priming: Prime joint substrates where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

D. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and back of joints.

E. Install sealants by proven techniques to comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.

2. Completely fill recesses provided for each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealants from surfaces adjacent to joint.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

G. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, to produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant to comply with sealant manufacturer's written instructions.

3.4 CLEANING AND PROTECTION

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

B. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

3.5 JOINT SEALANT SCHEDULE

A. Exterior joints in horizontal traffic surfaces:

1. Joint Locations:

a. Control and expansion joints in brick pavers.
b. Isolation and contraction joints in cast-in-place concrete slabs.
c. Tile control and expansion joints.

d. Joints between different materials listed above.
e. Other joints as indicated on Drawings.

2. Joint Sealant: Provide “Dynatrol II” sealant by Pecora, Dymeric 240 FC by Tremco, Sika, or approved equal.
3. Joint-Sealant Color: Match Architect's sample As selected by Architect from manufacturer's full range of colors .

B. Exterior joints in horizontal traffic surfaces subject to water immersion:
1. Joint Locations:
a. Joints as indicated on Drawings.
2. Joint Sealant: Provide Synthacaulk GC-2+ sealant by Pecora or approved equal.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors .

C. Exterior joints in vertical surfaces and horizontal nontraffic surfaces:

1. Joint Locations:

a. Construction joints in cast-in-place concrete.
b. Control and expansion joints in unit masonry.
c. Joints between metal panels.
d. Joints between different materials listed above.
e. Perimeter joints between materials listed above and frames of doors windows and louvers.
f. Control and expansion joints in ceilings and other overhead surfaces.
g. Other joints as indicated on Drawings.

2. Joint Sealant: Provide “Dynatrol II” sealant by Pecora, Dymeric 240 FC by Tremco, Sika, or approved equal.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Interior joints in horizontal traffic surfaces:

1. Joint Locations:

a. Isolation joints in cast-in-place concrete slabs.
b. Control and expansion joints in tile flooring.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Provide Synthacaulk GC-2+ sealant by Pecora or approved equal.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Interior joints in vertical surfaces and horizontal nontraffic surfaces:

1. Joint Locations:

    a. Control and expansion joints on exposed interior surfaces of exterior walls.
    b. Tile control and expansion joints.
    c. Vertical joints on exposed surfaces of unit masonry walls and partitions.
    d. Joints on underside of plant-precast structural concrete .
    e. Other joints as indicated on Drawings.

2. Joint Sealant: Provide Urexpan NR-200/Dynatred sealant by Pecora, Tremco, Sika, or approved equal.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

F. Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement:

1. Joint Locations:

    a. Control joints on exposed interior surfaces of exterior walls.
    b. Perimeter joints between interior wall surfaces and frames of interior doors windows and elevator entrances.
    c. Other joints as indicated on Drawings.

2. Joint Sealant: AC -20 + Silicone by Pecora Corporation, Tremflex 834 by Tremco, Sika, or approved equal.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

G. Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces:

1. Joint Locations:

    a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    b. Tile control and expansion joints where indicated.
    c. Other joints as indicated on Drawings.

2. Joint Sealant: Pecora 898 Silicone, Tremco Tremsil 200, Sika, or approved equal
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

H. Concealed mastics:

1. Joint Locations:

    a. Aluminum thresholds.
    b. Sill plates.

c. Other joints as indicated on Drawings.

2. Joint Sealant: Pecora BC-158 butyl Rubber Sealant.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

I. Fire Rated Joints:

1. Construction fire rated joints as indicated on the drawings with the following components complying with ANSI/UL 263 and ASTM E-119, one to four hour ratings.

   a. Joint Filler, "Ultra Block" or “Fibrex Mineral Wool” as recommended by Pecora, in thickness required to fill joints.
   b. Joint Sealant, "Dynatrol II" two part polyurethane as manufactured by Pecora, Tremco, sika, or approved equal.

END OF SECTION 07.9200

SECTION 08.0671 – DOOR HARDWARE SCHEDULE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section references specification sections relating to commercial door hardware for the following:

1. Swinging doors.
2. Sliding Doors.
3. Other doors to the extent indicated.

B. Commercial door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical and access control door hardware.
3. Electromechanical and access control door hardware power supplies, back-ups and surge protection.
4. Automatic operators.
5. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 01 Section "General Conditions”.
2. Division 06 Section “Rough Carpentry”.
3. Division 06 Section “Finish Carpentry”.
4. Division 08 Section “Door Hardware”.
5. Division 08 Section “Automatic Door Operators”.
6. Division 08 Section “Flush Wood Doors”.
7. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.
8. Division 26 Section "Electrical”

D. Codes and References: Comply with the version adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.

5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.
5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

    a. Type, style, function, size, label, hand, and finish of each door hardware item.
    b. Manufacturer of each item.
    c. Fastenings and other pertinent information.
    d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    e. Explanation of abbreviations, symbols, and codes contained in schedule.
    f. Mounting locations for door hardware.
    g. Door and frame sizes and materials.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
b. Complete (risers, point-to-point) access control system block wiring diagrams.
c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.

E. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives.

B. Project Record Documents: Provide record documentation of as-built door hardware sets in digital format (.pdf, .docx, .xlsx, .csv) and as required in Division 01, Project Record Documents. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.

C. Warranties and Maintenance: Special warranties and maintenance agreements specified in the Related Sections.

1.5 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

F. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.

G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

I. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.7 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.8 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

1.9 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Refer to "**PART 3** – **EXECUTION**" for required specification sections.

PART 3 - EXECUTION

3.1 DOOR HARDWARE SETS

A. The door hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.

2. The supplier is responsible for handing and sizing all products.

3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Products listed in the hardware sets shall be supplied by and in accordance with the requirements described in the specification section as noted for each item.

1. Section 08 71 00 – Door Hardware.
2. Section 08 71 13 – Automatic Door Operators.

C. Manufacturer's Abbreviations:

1. GS - ASSA ABLOY Glass Solutions
2. MK - McKinney
3. MR - Markar
4. PE - Pemko
5. NO - Norton Rixson
6. RO - Rockwood
7. SU - Securitron
8. SA - SARGENT
9. AD - Adams Rite
10. OT - Other

HARDWARE SETS

Set: 1.0

Doors: 100.1, 100.2, 107.1, 125.1, 129.1, S2-1.1

1 Continuous Hinge	CFM__SLF-HD1 PT		PE	087100	
1 Electric Power Transfer	EL-CEPT	630	SU	087100	⚡
1 Rim Exit Device, Storeroom	55 56 PE8804 862	US32D	SA	087100	⚡
1 Surface Closer	351 CPS	EN	SA	087100	
1 Gasketing	By Alum Storefront Mfr		OT		
1 Rain Guard	346C (Omit at Overhang)		PE	087100	

1 Sweep	18061CNB		PE	087100	
1 Threshold	273x224AFGT		PE	087100	
1 Harness, Frame	QC-C1500P		MK	087100	⚡
1 Harness, Exits	QC-C__P		MK	087100	⚡
1 Card Reader	By Security System Supplier		OT		
1 Position Switch	DPS-M/W-BK		SU	087100	⚡
1 Power Supply	AQD/AQL Series		SU	087100	⚡
1 Wiring Diagram	Elevation and Point to Point as Specified		OT		

Notes: Theory of operation:
- Door normally closed and secure.
- Presenting valid credential at card reader retracts latch in exit device, allowing ingress.
- In the event of power failure, door remains closed and secure.
- Manual key override provided.
- Free egress allowed at all times.

Set: 2.0

Doors: 114.1

2 Continuous Hinge	CFM__SLF-HD1 PT		PE	087100	
2 Electric Power Transfer	EL-CEPT	630	SU	087100	⚡
1 Mullion	L980	PC	SA	087100	
1 Rim Exit Device, Storeroom	55 56 PE8804 862	US32D	SA	087100	⚡
1 Rim Exit Device, Dummy	55 56 PE8810 862	US32D	SA	087100	⚡
1 Mullion Cylinder	980C1	US26D	SA	087100	
2 Automatic Opener	6300 Series	689	NO	087100	⚡
1 Gasketing	By Alum Storefront Mfr		OT		
1 Rain Guard	346C (Omit at Overhang)		PE	087100	
2 Sweep	18061CNB		PE	087100	
1 Threshold	273x224AFGT		PE	087100	
2 Harness, Frame	QC-C1500P		MK	087100	⚡
2 Harness, Exits	QC-C__P		MK	087100	⚡
1 Card Reader	By Security System Supplier		OT		
2 Touchless Actuator	674		NO	087100	
2 Position Switch	DPS-M/W-BK		SU	087100	⚡
1 Power Supply	AQD/AQL Series		SU	087100	⚡

1 Wiring Diagram	Elevation and Point to Point as Specified		OT		

Notes: Theory of operation:
- Doors normally closed and secure.
- Presenting valid credential at card reader retracts latches in exit devices, allowing ingress.
- Ingress at either leaf via touchless actuator after validation of credential.
- 56- option allows for electronic dogging of opening (per building owner/occupant) for push/pull operator and free ingress via actuator.
- In the event of power failure, power is lost to operators, and doors remain closed and secure.
- Manual key override provided at active leaf.
- Free egress allowed at both leaves via exit devices at all times and via actuator when power is on..

Set: 2.1

Doors: 001.1, 001.2

2 Storefront Panic Device	PDU8500-3	US32D	RO	087100	
1 Electric Strike Kit	ESK-1600-DBL	US32D	RO	087100	
1 Card Reader	By Security System Supplier		OT		
2 Position Switch	DPS-M/W-BK		SU	087100	
1 Power Supply	AQD/AQL Series		SU	087100	
1 Balance of Hardware	By Door Manufacturer		OT		
1 Wiring Diagram	Elevation and Point to Point as Specified		OT		

Notes: Theory of Operation:
- Doors normally closed and secure.
- Presenting valid credential at card reader energizes electric strike, allowing ingress at either leaf.
- In the event of power failure, doors remain closed and secure.
- Manual key override provided.
- Free egress allowed at both leaves at all times.

Set: 3.0

Doors: 151.2, 151.3

1 Continuous Hinge	CFM__SLF-HD1		PE	087100	
1 Rim Exit Device, Exit Only	PE8810 EO	US32D	SA	087100	
1 Surface Closer	351 CPS	EN	SA	087100	
1 Gasketing	By Alum Storefront Mfr		OT		

1 Rain Guard	346C (Omit at Overhang)		PE	087100
1 Sweep	18061CNB		PE	087100
1 Threshold	273x224AFGT		PE	087100

Set: 4.0

Doors: 200, 229.1, 229.2

1 Continuous Hinge	CFM__SLF-HD1		PE	087100
1 Mortise Deadlock	1850S	628	AD	087100
1 Push Bar & Pull	BF15747	US32D	RO	087100
1 Surface Closer	351 UO	EN	SA	087100
1 Ext Floor Stop	463-RKW	US32D	RO	087100
1 Gasketing	By Alum Storefront Mfr		OT	
1 Rain Guard	346C (Omit at Overhang)		PE	087100
1 Sweep	18061CNB		PE	087100
1 Threshold	273x224AFGT		PE	087100

Set: 5.0

Doors: 151.1

3 Hinge, Heavy Wt, Ext	T4A3386 [NRP]	US32D	MK	087100	
1 Electric Power Transfer	EL-CEPT	630	SU	087100	⚡
1 Rim Exit Device, Storeroom	55 56 PE8804 862	US32D	SA	087100	⚡
1 Surface Closer	351 UO	EN	SA	087100	
1 Ext Floor Stop	463-RKW	US32D	RO	087100	
1 Gasketing	Integral In Frame Assembly		OT		
1 Rain Guard	346C (Omit at Overhang)		PE	087100	
1 Sweep	18061CNB		PE	087100	
1 Threshold	273x224AFGT		PE	087100	
1 Harness, Frame	QC-C1500P		MK	087100	⚡
1 Harness, Exits	QC-C__P		MK	087100	⚡
1 Card Reader	By Security System Supplier		OT		
1 Position Switch	DPS-M/W-BK		SU	087100	⚡
1 Power Supply	AQD/AQL Series		SU	087100	⚡
1 Wiring Diagram	Elevation and Point to Point as Specified		OT		

Notes: Theory of operation:
- Door normally closed and secure.
- Presenting valid credential at card reader retracts latch in exit device, allowing ingress.
- In the event of power failure, door remains closed and secure.
- Manual key override provided.
- Free egress allowed at all times.

Set: 6.0

Doors: 130.2

6 Hinge, Heavy Wt, Ext	T4A3386 [NRP]	US32D	MK	087100	
1 Electric Power Transfer	EL-CEPT	630	SU	087100	⚡
1 Self Latching Bolt	2845	US26D	RO	087100	
1 Dust Proof Strike	570	US26D	RO	087100	
1 Electrified Mortise Lock	IDP NAC-82271-__V LNND	US32D	SA	087100	⚡
1 Coordinator	2600 Series	Black	RO	087100	
2 Surface Closer	351 CPS	EN	SA	087100	
2 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100	
1 Gasketing	Integral In Frame Assembly		OT		
1 Rain Guard	346C (Omit at Overhang)		PE	087100	
2 Sweep	18061CNB		PE	087100	
1 Threshold	273x224AFGT		PE	087100	
1 Harness, Frame	QC-C1500P		MK	087100	⚡
1 Harness, Locks	QC-C__P		MK	087100	⚡
1 Card Reader	By Security System Supplier		OT		
1 Power Supply	AQD/AQL Series		SU	087100	⚡
1 Wiring Diagram	Elevation and Point to Point as Specified		OT		

Notes: Theory of Operation:
- Doors normally closed and secure.
- Presenting valid credential at card reader energizes lock, allowing ingress at active leaf.
- In the event of power failure, doors remain closed and secure.
- DPS and RX integrated into lockset.
- Manual key override provided at active leaf.
- Free egress allowed at active leaf at all times.

Set: 6.1

Doors: 127.2

6 Hinge, Heavy Wt, Ext	T4A3386 [NRP]	US32D	MK	087100	
1 Electric Power Transfer	EL-CEPT	630	SU	087100	⚡
1 Mullion	L980	PC	SA	087100	
1 Rim Exit Device, Storeroom	55 56 PE8804 862	US32D	SA	087100	⚡
1 Rim Exit Device, Exit Only	PE8810 EO	US32D	SA	087100	
2 Surface Closer	351 CPS	EN	SA	087100	
2 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100	
1 Gasketing	Integral In Frame Assembly		OT		
1 Rain Guard	346C (Omit at Overhang)		PE	087100	
2 Sweep	18061CNB		PE	087100	
1 Threshold	273x224AFGT		PE	087100	
1 Harness, Frame	QC-C1500P		MK	087100	⚡
1 Harness, Locks	QC-C__P		MK	087100	⚡
1 Card Reader	By Security System Supplier		OT		
2 Position Switch	DPS-M/W-BK		SU	087100	⚡
1 Power Supply	AQD/AQL Series		SU	087100	⚡
1 Wiring Diagram	Elevation and Point to Point as Specified		OT		

Notes: Theory of Operation:
- Doors normally closed and secure.
- Presenting valid credential at card reader retracts latch in exit device, allowing ingress at active leaf.
- In the event of power failure, doors remain closed and secure.
- Manual key override provided at active leaf.
- Free egress allowed at both leaves at all times.

Set: 7.0

Doors: 128

3 Hinge, Heavy Wt, Ext	T4A3386 [NRP]	US32D	MK	087100	
1 Electric Power Transfer	EL-CEPT	630	SU	087100	⚡
1 Electrified Mortise Lock	IDP NAC-82271-__V LNND	US32D	SA	087100	⚡
1 Surface Closer	351 UO	EN	SA	087100	
1 Wall/Floor Stop	409 [OR] 441	US26D	RO	087100	

1 Gasketing	Integral In Frame Assembly		OT		
1 Rain Guard	346C (Omit at Overhang)		PE	087100	
1 Sweep	18061CNB		PE	087100	
1 Threshold	273x224AFGT		PE	087100	
1 Harness, Frame	QC-C1500P		MK	087100	⚡
1 Harness, Locks	QC-C__P		MK	087100	⚡
1 Card Reader	By Security System Supplier		OT		
1 Power Supply	AQD/AQL Series		SU	087100	⚡
1 Wiring Diagram	Elevation and Point to Point as Specified		OT		

Notes: Theory of Operation:
- Door normally closed and secure.
- Presenting valid credential at card reader energizes lock, allowing ingress.
- In the event of power failure, door remains closed and secure.
- DPS and RX integrated into lockset.
- Manual key override provided.
- Free egress allowed at all times.

Set: 8.0

Doors: 201.2

1 Continuous Hinge	CFM__SLF-HD1 PT		PE	087100	
1 Electric Power Transfer	EL-CEPT	630	SU	087100	⚡
1 Fail Safe Exit Device	55 PE8875-__V WEND	US32D	SA	087100	⚡
1 Surface Closer	351 UO	EN	SA	087100	
1 Wall/Floor Stop	409 [OR] 441	US26D	RO	087100	
1 Gasketing	By Alum Storefront Mfr		OT		
1 Threshold	272A		PE	087100	
1 Harness, Frame	QC-C1500P		MK	087100	⚡
1 Harness, Exits	QC-C__P		MK	087100	⚡
1 Card Reader	By Security System Supplier		OT		
1 Position Switch	DPS-M/W-BK		SU	087100	⚡
1 Power Supply	AQD/AQL Series		SU	087100	⚡
1 Wiring Diagram	Elevation and Point to Point as Specified		OT		

Notes: Theory of operation:
- Door normally closed and secure.
- Presenting valid credential at card reader cuts power to opening, unlocks trim of exit device, and allows ingress.
- In the event of power failure, door becomes free at both sides.
- Manual key override provided.
- Free egress allowed at all times.

Set: 9.0

Doors: S1-2

1 Continuous Hinge	CFM__SLF-HD1 PT		PE	087100	
1 Electric Power Transfer	EL-CEPT	630	SU	087100	⚡
1 Fail Safe Exit Device	55 PE8875-__V WEND	US32D	SA	087100	⚡
1 Surface Closer	351 CPS	EN	SA	087100	
1 Gasketing	By Alum Storefront Mfr		OT		
1 Threshold	272A		PE	087100	
1 Harness, Frame	QC-C1500P		MK	087100	⚡
1 Harness, Exits	QC-C__P		MK	087100	⚡
1 Card Reader	By Security System Supplier		OT		
1 Position Switch	DPS-M/W-BK		SU	087100	⚡
1 Power Supply	AQD/AQL Series		SU	087100	⚡
1 Wiring Diagram	Elevation and Point to Point as Specified		OT		

Notes: Theory of operation:
- Door normally closed and secure.
- Presenting valid credential at card reader cuts power to opening, unlocks trim of exit device, and allows ingress.
- In the event of power failure, door becomes free at both sides.
- Manual key override provided.
- Free egress allowed at all times.

Set: 10.0

Doors: 114.2

2 Continuous Hinge	CFM__SLF-HD1		PE	087100	
2 Push Bar & Pull	BF15747	US32D	RO	087100	

2 Automatic Opener	6300 Series	689	NO	087100	
1 Gasketing	By Alum Storefront Mfr		OT		
1 Threshold	272A		PE	087100	
2 Touchless Actuator	674		NO	087100	

Set: 11.0

Doors: 107.2, 129.2

1 Continuous Hinge	CFM__SLF-HD1		PE	087100	
1 Push Bar & Pull	BF15747	US32D	RO	087100	
1 Surface Closer	351 UO	EN	SA	087100	
1 Wall/Floor Stop	409 [OR] 441	US26D	RO	087100	
1 Gasketing	By Alum Storefront Mfr		OT		
1 Threshold	272A		PE	087100	

Set: 12.0

Doors: 125.2

1 Continuous Hinge	CFM__SLF-HD1		PE	087100	
1 Push Bar & Pull	BF15747	US32D	RO	087100	
1 Surface Closer	351 CPS	EN	SA	087100	
1 Gasketing	By Alum Storefront Mfr		OT		
1 Threshold	272A		PE	087100	

Set: 13.0

Doors: 201.1

6 Hinge, Heavy Wt, Int	T4A3786 [NRP]	US26D	MK	087100	
2 Electric Power Transfer	EL-CEPT	630	SU	087100	
1 Mullion	L980	PC	SA	087100	
1 Rim Exit Device, Storeroom	12 55 56 PE8804 WEND	US32D	SA	087100	
1 Rim Exit Device, Dummy	12 55 56 PE8810 WEND	US32D	SA	087100	
1 Mullion Cylinder	980C1	US26D	SA	087100	
2 Surface Closer	351 UO	EN	SA	087100	
2 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100	
2 Wall/Floor Stop	409 [OR] 441	US26D	RO	087100	

1 Harness, Frame	QC-C1500P		MK	087100	
1 Harness, Exits	QC-C__P		MK	087100	
1 Card Reader	By Security System Supplier		OT		
1 Position Switch	DPS-M/W-BK		SU	087100	
1 Power Supply	AQD/AQL Series		SU	087100	
1 Wiring Diagram	Elevation and Point to Point as Specified		OT		

Notes: Theory of operation:
- Doors normally closed and secure.
- Presenting valid credential at card reader retracts latches in exit devices, allowing ingress.
- 56- prefix allows for remote dogging of devices to allow for push/pull operation.
- In the event of power failure or actuation of fire alarm, remote dogging is released (if engaged), and doors remain closed and secure.
- Manual key override provided at active leaf.
- Free egress allowed at both leaves at all times.

Set: 14.0

Doors: S2-2.1, S2-2.2, S3-2

3 Hinge, Heavy Wt, Int	T4A3786 [NRP]	US26D	MK	087100	
1 Electric Power Transfer	EL-CEPT	630	SU	087100	
1 Fail Safe Exit Device	55 PE8875-__V WEND	US32D	SA	087100	
1 Surface Closer	351 UO	EN	SA	087100	
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100	
1 Wall/Floor Stop	409 [OR] 441	US26D	RO	087100	
1 Gasketing	S88BL		PE	087100	
1 Harness, Frame	QC-C1500P		MK	087100	
1 Harness, Exits	QC-C__P		MK	087100	
1 Card Reader	By Security System Supplier		OT		
1 Position Switch	DPS-M/W-BK		SU	087100	
1 Power Supply	AQD/AQL Series		SU	087100	
1 Wiring Diagram	Elevation and Point to Point as Specified		OT		

Notes: Theory of operation:
- Door normally closed and secure.
- Presenting valid credential at card reader cuts power to opening, unlocks trim of exit device, and

allows ingress.
- In the event of power failure or actuation of fire alarm, door becomes free at both sides.
- Manual key override provided.
- Free egress allowed at all times.

Set: 15.0

Doors: S2-1.2, S2-1.3

3 Hinge, Heavy Wt, Int	T4A3786 [NRP]	US26D	MK	087100	
1 Rim Exit Device, Passage	12 PE8815 WEL	US32D	SA	087100	
1 Surface Closer	351 UO	EN	SA	087100	
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100	
1 Wall/Floor Stop	409 [OR] 441	US26D	RO	087100	
1 Gasketing	S88BL		PE	087100	

Set: 16.0

Doors: 214.1, 214.2

3 Hinge, Full Mortise	TA2714-MCK [NRP-STD]	US26D	MK	087100	
1 Electric Power Transfer	EL-CEPT	630	SU	087100	⚡
1 Electrified Mortise Lock	IDP NAC-82270-__V LNND	US26D	SA	087100	⚡
1 Surface Closer	351 UO	EN	SA	087100	
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100	
1 Wall/Floor Stop	409 [OR] 441	US26D	RO	087100	
1 Gasketing	S88BL		PE	087100	
1 Harness, Frame	QC-C1500P		MK	087100	⚡
1 Harness, Locks	QC-C__P		MK	087100	⚡
1 Card Reader	By Security System Supplier		OT		
1 Power Supply	AQD/AQL Series		SU	087100	⚡
1 Wiring Diagram	Elevation and Point to Point as Specified		OT		

Notes: Theory of Operation:
- Door normally closed and secure.
- Presenting valid credential at card reader cuts power to lock, allowing ingress.
- In the event of power failure or actuation of fire alarm, door becomes free at both sides.
- DPS and RX integrated into lockset.
- Manual key override provided.

- Free egress allowed at all times.

Set: 17.0

Doors: 100.3, 101, 102, 103, 105, 108, 113, 116.2, 120, 121, 122, 123, 124, 133, 149, 213, 215, 217, 219, 230

3 Hinge, Full Mortise	TA2714-MCK [NRP-STD]	US26D	MK	087100	
1 Electric Power Transfer	EL-CEPT	630	SU	087100	⚡
1 Electrified Mortise Lock	IDP NAC-82271-__V LNND	US26D	SA	087100	⚡
1 Surface Closer	351 UO	EN	SA	087100	
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100	
1 Wall/Floor Stop	409 [OR] 441	US26D	RO	087100	
3 Silencer	608-RKW/609		RO	087100	
1 Harness, Frame	QC-C1500P		MK	087100	⚡
1 Harness, Locks	QC-C__P		MK	087100	⚡
1 Card Reader	By Security System Supplier		OT		
1 Power Supply	AQD/AQL Series		SU	087100	⚡
1 Wiring Diagram	Elevation and Point to Point as Specified		OT		

Notes: Theory of Operation:
- Door normally closed and secure.
- Presenting valid credential at card reader energizes lock, allowing ingress.
- In the event of power failure, door remains closed and secure.
- DPS and RX integrated into lockset.
- Manual key override provided.
- Free egress allowed at all times.

Set: 17.1

Doors: 127.1

3 Hinge, Heavy Wt, Int	T4A3786 [NRP]	US26D	MK	087100	
1 Electric Power Transfer	EL-CEPT	630	SU	087100	⚡
1 Rim Exit Device, Storeroom	12 55 56 PE8804 WEND	US32D	SA	087100	⚡
1 Surface Closer	351 UO	EN	SA	087100	

1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100	
1 Wall/Floor Stop	409 [OR] 441	US26D	RO	087100	
1 Gasketing	S88BL		PE	087100	
1 Harness, Frame	QC-C1500P		MK	087100	
1 Harness, Locks	QC-C__P		MK	087100	
1 Card Reader	By Security System Supplier		OT		
1 Position Switch	DPS-M/W-BK		SU	087100	
1 Power Supply	AQD/AQL Series		SU	087100	
1 Wiring Diagram	Elevation and Point to Point as Specified		OT		

Notes: Theory of Operation:
- Door normally closed and secure.
- Presenting valid credential at card reader retracts latch in exit device, allowing ingress.
- In the event of power failure, door remains closed and secure.
- Manual key override provided.
- Free egress allowed at all times.

Set: 18.0

Doors: 104

3 Hinge, Full Mortise	TA2714-MCK [NRP-STD]	US26D	MK	087100	
1 Electric Power Transfer	EL-CEPT	630	SU	087100	
1 Electrified Mortise Lock	IDP NAC-82271-__V LNND	US26D	SA	087100	
1 Surface Closer	351 CPS	EN	SA	087100	
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100	
3 Silencer	608-RKW/609		RO	087100	
1 Harness, Frame	QC-C1500P		MK	087100	
1 Harness, Locks	QC-C__P		MK	087100	
1 Card Reader	By Security System Supplier		OT		
1 Power Supply	AQD/AQL Series		SU	087100	
1 Wiring Diagram	Elevation and Point to Point as Specified		OT		

Notes: Theory of Operation:
- Door normally closed and secure.
- Presenting valid credential at card reader energizes lock, allowing ingress.
- In the event of power failure, door remains closed and secure.

- DPS and RX integrated into lockset.
- Manual key override provided.
- Free egress allowed at all times.

Set: 19.0

Doors: 220

3 Hinge, Full Mortise	TA2714-MCK [NRP-STD]	US26D	MK	087100	
1 Electric Power Transfer	EL-CEPT	630	SU	087100	⚡
1 Electrified Mortise Lock	IDP NAC-82271-__V LNND	US26D	SA	087100	⚡
1 Concealed OH Stop	5-_36	652	NO	087100	
1 Surface Closer	351 UO	EN	SA	087100	
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100	
3 Silencer	608-RKW/609		RO	087100	
1 Harness, Frame	QC-C1500P		MK	087100	⚡
1 Harness, Locks	QC-C__P		MK	087100	⚡
1 Card Reader	By Security System Supplier		OT		
1 Power Supply	AQD/AQL Series		SU	087100	⚡
1 Wiring Diagram	Elevation and Point to Point as Specified		OT		

Notes: Theory of Operation:
- Door normally closed and secure.
- Presenting valid credential at card reader energizes lock, allowing ingress.
- In the event of power failure, door remains closed and secure.
- DPS and RX integrated into lockset.
- Manual key override provided.
- Free egress allowed at all times.

Set: 20.0

Doors: 107.3, 116.1, 131.1, 134, 140, 208, 210

3 Hinge, Full Mortise	TA2714-MCK [NRP-STD]	US26D	MK	087100	
1 Electric Power Transfer	EL-CEPT	630	SU	087100	⚡
1 Electrified Mortise Lock	IDP NAC-82271-__V LNND	US26D	SA	087100	⚡
1 Surface Closer	351 UO	EN	SA	087100	
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100	
1 Wall/Floor Stop	409 [OR] 441	US26D	RO	087100	

1 Gasketing	S88BL		PE	087100	
1 Harness, Frame	QC-C1500P		MK	087100	⚡
1 Harness, Locks	QC-C__P		MK	087100	⚡
1 Card Reader	By Security System Supplier		OT		
1 Power Supply	AQD/AQL Series		SU	087100	⚡
1 Wiring Diagram	Elevation and Point to Point as Specified		OT		

Notes: Theory of Operation:
- Door normally closed and secure.
- Presenting valid credential at card reader energizes lock, allowing ingress.
- In the event of power failure or actuation of fire alarm, door remains closed and secure.
- DPS and RX integrated into lockset.
- Manual key override provided.
- Free egress allowed at all times.

Set: 21.0

Doors: 136

3 Hinge, Full Mortise	TA2714-MCK [NRP-STD]	US26D	MK	087100
1 Storeroom/Closet Lock	8204 LNND	US26D	SA	087100
1 Wall/Floor Stop	409 [OR] 441	US26D	RO	087100
3 Silencer	608-RKW/609		RO	087100

Set: 22.0

Doors: 130.1

3 Hinge, Full Mortise	TA2714-MCK [NRP-STD]	US26D	MK	087100
1 Storeroom/Closet Lock	8204 LNND	US26D	SA	087100
1 Surface Closer	351 UO	EN	SA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Wall/Floor Stop	409 [OR] 441	US26D	RO	087100
3 Silencer	608-RKW/609		RO	087100

Set: 23.0

Doors: 110, 112, 138, 222, 228

3 Hinge, Full Mortise	TA2714-MCK [NRP-STD]	US26D	MK	087100

1 Classroom Lock	8237 LNND	US26D	SA	087100
1 Wall/Floor Stop	409 [OR] 441	US26D	RO	087100
3 Silencer	608-RKW/609		RO	087100

Set: 24.0

Doors: 118, 135

3 Hinge, Full Mortise	TA2714-MCK [NRP-STD]	US26D	MK	087100
1 Classroom Lock	8237 LNND	US26D	SA	087100
1 Concealed OH Stop	5-_36	652	NO	087100
3 Silencer	608-RKW/609		RO	087100

Set: 25.0

Doors: 209

3 Hinge, Full Mortise	TA2714-MCK [NRP-STD]	US26D	MK	087100
1 Classroom Lock	8237 LNND	US26D	SA	087100
1 Surface Closer	351 UO	EN	SA	087100
1 Wall/Floor Stop	409 [OR] 441	US26D	RO	087100
1 Gasketing	S88BL		PE	087100

Set: 26.0

Doors: 137, 143, 225, 226

3 Hinge, Full Mortise	TA2714-MCK [NRP-STD]	US26D	MK	087100
1 Privacy Lock	LB V21 8265 LNND	US26D	SA	087100
1 Surface Closer	351 UO	EN	SA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Wall/Floor Stop	409 [OR] 441	US26D	RO	087100
1 Gasketing	S88BL		PE	087100

Set: 27.0

Doors: 109, 111, 141, 142, 212, 216, 218

3 Hinge, Full Mortise, Ext	TA2314 [NRP]	US32D	MK	087100
1 Privacy Lock	LB V21 8265 LNND	US32D	SA	087100
1 Surface Closer	351 UO	EN	SA	087100

1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Wall Stop	409 [OR] 441	US32D	RO	087100
1 Gasketing	S88BL		PE	087100

Set: 28.0

Doors: 145, 223

3 Hinge, Full Mortise	TA2714-MCK [NRP-STD]	US26D	MK	087100
1 Passage Latch	8215 LNND	US26D	SA	087100
1 Wall/Floor Stop	409 [OR] 441	US26D	RO	087100
3 Silencer	608-RKW/609		RO	087100

Set: 29.0

Doors: 221.1, 221.2

3 Hinge, Full Mortise	TA2714-MCK [NRP-STD]	US26D	MK	087100
1 Passage Latch	8215 LNND	US26D	SA	087100
1 Door Stop & Holder	491-RKW	US26D	RO	087100
3 Silencer	608-RKW/609		RO	087100

Set: 30.0

Doors: 131.2, 139.2, 144, 146, 148, 207, 211

3 Hinge, Full Mortise	TA2714-MCK [NRP-STD]	US26D	MK	087100
1 Passage Latch	8215 LNND	US26D	SA	087100
1 Surface Closer	351 UO	EN	SA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Wall/Floor Stop	409 [OR] 441	US26D	RO	087100
1 Gasketing	S88BL		PE	087100

Set: 31.0

Doors: 117, 119

3 Hinge, Full Mortise	TA2714-MCK [NRP-STD]	US26D	MK	087100
1 Heavy Duty Push/Pull	111x73C/73CL	US32D	RO	087100
1 Surface Closer	351 UO	EN	SA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100

1 Wall/Floor Stop	409 [OR] 441	US26D	RO	087100
1 Gasketing	S88BL		PE	087100

Set: 32.0

Doors: 100.4, 100.5, 126, 150.4, 150.5, 150.6

1 All Hardware	By Door Manufacturer		OT	

Set: 32.1

Doors: 139.1

6 Hinge, Full Mortise	TA2714-MCK [NRP-STD]	US26D	MK	087100
1 Self Latching Bolt	2845	US26D	RO	087100
1 Dust Proof Strike	570	US26D	RO	087100
1 Passage Latch	8215 LNND	US26D	SA	087100
1 Coordinator	2600 Series	Black	RO	087100
2 Surface Closer	351 CPS	EN	SA	087100
2 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Astragal	S771x6BL		PE	087100
1 Gasketing	S88BL		PE	087100
1 All Hardware	By Door Manufacturer		OT	

Set: 33.0

Doors: 100.6, 100.7, 150.7, 150.8, 150.9

1 Cylinder	As Required	US15	SA	087100
1 Balance of Hardware	By Overhead Door Manufacturer		OT	

Set: 34.0

Doors: 301

3 Hinge, Heavy Wt, Ext	T4A3386 [NRP]	US32D	MK	087100
1 Storeroom/Closet Lock	8204 LNND	US26D	SA	087100
1 Surface Closer	351 CPS	EN	SA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Gasketing	Integral In Frame Assembly		OT	
1 Rain Guard	346C (Omit at Overhang)		PE	087100

1 Sweep	18061CNB		PE	087100
1 Threshold	273x224AFGT		PE	087100

Set: 35.0

Doors: ST2-3

3 Hinge, Heavy Wt, Ext	T4A3386 [NRP]	US32D	MK	087100
1 Asylum/Institutional Lock	8217 LNND	US32D	SA	087100
1 Surface Closer	351 CPS	EN	SA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Gasketing	Integral In Frame Assembly		OT	
1 Rain Guard	346C (Omit at Overhang)		PE	087100
1 Sweep	18061CNB		PE	087100
1 Threshold	273x224AFGT		PE	087100

END OF SECTION 08.0671

SECTION 08.1113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Standard and custom hollow metal doors and frames.
2. Steel sidelight, borrowed lite and transom frames.
3. Louvers installed in hollow metal doors.
4. Light frames and glazing installed in hollow metal doors.
5. Frames for interior glazed openings.
6. Fire-rated door and frame assemblies

B. Related Sections:

1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
2. Division 08 Section "Flush Wood Doors": Wood doors installed in hollow metal frames.
3. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
4. Division 09 Section "Gypsum Board Assemblies": Spot-grouting frames installed in steel-framed gypsum board partitions.
5. Division 08 Section "Door Hardware".
6. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.

5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 DEFINITIONS

A. Steel Sheet Thicknesses: Thickness dimensions, including those referenced in ANSI A250.8, are minimums as defined in referenced ASTM standards for both uncoated steel sheet and the uncoated base metal of metallic-coated steel sheets.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.

B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.

C. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Details and locations of reinforcement and preparations for hardware.
5. Details of anchorages, joints, field splices, and connections.

6. Details of each different wall opening condition.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Coordination of glazing frames and stops with glass and glazing requirements.
10. Details of conduit and preparations for power, signal, and control systems.+

D. Door Schedule: Use same reference designations indicated on Drawings in preparing schedule for doors and frames.

E. Samples for Verification:

1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.

B. Quality Standard: In addition to requirements specified, comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".+

C. Hollow Metal Door and Frame Standard: Comply with ANSI A 250.8, unless more stringent requirements are indicated.

D. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40” above sill) or UL 10C.

1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
3. Smoke Control Door Assemblies: Comply with NFPA 105.

    a. UL 1784, with test conducted according to International Building Code, Section 715.3.3.
    b. Smoke "S" Label: Doors to bear “S” label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

E. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having

jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.

F. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Inspect doors and frames on delivery for damage, and notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.

D. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity. If door packaging becomes wet, remove cartons immediately.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CECO Door Products (C).
2. Curries Company (CU).
3. Steelcraft (S).

2.2 MATERIALS

A. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

D. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 HOLLOW METAL DOORS

A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.

B. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.
2. Core Construction: Manufacturer's standard polystyrene. Where indicated, provide doors fabricated as thermal-rated assemblies with a minimum R-value of 2.8 or better.
3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

C. Interior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.
2. Core Construction: Manufacturer's standard kraft-paper honeycomb, or one-piece polystyrene core, securely bonded to both faces.

    a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.

3. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.
4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.
5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

D. Interior Doors at Exit Stairs: Provide doors complying with requirements indicated below by referencing ANSI 250.8 for level and model and ANSI A250.4 for physical-endurance level:
1. Level 3 and Physical Performance Level B (Extra Heavy Duty), Model 2 (Seamless).
2. Door Face Thickness: 0.053 inch (16 gage).

E. Vision Lite Systems: Manufacturer's standard kits consisting of glass lite moldings to accommodate glass thickness and size of vision lite indicated.

F. Manufacturers Basis of Design:

1. Curries Company (CU) - Polystyrene Core - 707 Series.

2.4 HOLLOW METAL FRAMES

A. General: Provide steel frames for doors, transoms, sidelights, borrowed lights, and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.

B. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.
3. Manufacturers Basis of Design:

a. Curries Company (CU) – M Series.

C. Interior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
3. Manufacturers Basis of Design:

a. Curries Company (CU) - M Series.

D. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

E. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

F. Door Silencers: Except on weather-stripped frames, fabricate stops to receive three silencers on strike jambs of single-door frames and two silencers on heads of double-door frames.

G. Plaster Guards: Provide 0.016-inch-thick, steel sheet plaster guards or mortar boxes to close off interior of openings; place at back of hardware cutouts where mortar or other materials might obstruct hardware operation.

H. Supports and Anchors: Fabricated from not less than 0.042-inch-thick, electrolytic zinc-coated or metallic-coated steel sheet.

I. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153/A 153M, Class C or D as applicable.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.

B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.

C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.6 LIGHT OPENINGS AND GLAZING

A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator’s shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.

B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.

C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.

D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.7 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.8 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.

C. Exterior Door Construction: For exterior locations and elsewhere as indicated, fabricate doors, panels, and frames from metallic-coated steel sheet. Close top and bottom edges of doors flush as an integral part of door construction or by addition of 0.053-inch-thick, metallic-coated steel channels with channel webs placed even with top and bottom edges. Provide weep-hole openings in bottom of exterior doors to permit moisture to escape.

D. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.

E. Interior Door Faces: Fabricate exposed faces of doors from cold-rolled steel sheet, unless otherwise indicated.

F. Core Construction: One of the following manufacturer's standard core materials that produce a door complying with SDI standards:
   1. Resin-impregnated kraft/paper honeycomb.
   2. Vertical steel stiffeners.
   3. Rigid mineral-fiber board.

G. Clearances for Non-Fire-Rated Doors: Not more than 1/8 inch at jambs and heads, except not more than 1/4 inch between pairs of doors. Not more than 3/4 inch at bottom.

H. Clearances for Fire-Rated Doors: As required by NFPA 80.

I. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

J. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.

K. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.

L. Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors fabricated as thermal-insulating door and frame assemblies and tested according to ASTM C 236 or ASTM C 976 on fully operable door assemblies.

1. Unless otherwise indicated, provide thermal-rated assemblies with U-value of 0.41 Btu/sq. ft. x h x deg F or better.

M. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.

N. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections

O. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

    a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.

3. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
4. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
5. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
6. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
7. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Two anchors per jamb up to 60 inches high.

2) Three anchors per jamb from 60 to 90 inches high.
3) Four anchors per jamb from 90 to 120 inches high.
4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

1) Three anchors per jamb up to 60 inches high.
2) Four anchors per jamb from 60 to 90 inches high.
3) Five anchors per jamb from 90 to 96 inches high.
4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.

8. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
9. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.

P. Frame Construction: Fabricate frames to shape shown.

Q. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

R. Glazing Stops: Manufacturer's standard, formed from 0.032-inch-thick steel sheet.
1. Provide nonremovable stops on outside of exterior doors and on secure side of interior doors for glass.
2. Provide screw-applied, removable, glazing stops on inside of glass.

S. Astragals: As required by NFPA 80 to provide fire ratings indicated.

2.9 STEEL FINISHES

A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.

C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.

1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:
   a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
   b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
   c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
   d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

END OF SECTION 08.1113

SECTION 08.1416 – FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.
4. Fire-Rated Wood Doors with wood-veneer faces.

B. Related Sections:

1. Division 06 Section “Finish Carpentry”
2. Division 08 Section "Glazing" for glass view panels in flush wood doors.

1.3 SUBMITTALS

A. Product Data: For each type of door indicated. Include the following details of core and edge construction.
1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door louvers.
5. Door trim for openings.
6. Door frame construction.
7. Factory-machining criteria.
8. Factory- finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate doors to be factory finished and finish requirements.
4. Indicate fire-protection ratings for fire-rated doors.

C. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.
2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.

    a. Provide samples for each species of veneer and solid lumber required.

3. Louver blade and frame sections, 6 inches long, for each material and finish specified.
4. Frames for light openings, 6 inches long, for each material, type, and finish required.

D. Warranty: Doors shall be warranted by the manufacturer to be free of manufacturing defects for the life of the installation in the form of the "Standard Door Guarantee" published by the National Wood Window and Door Association (NWWDA), latest edition. Submit written guarantee in duplicate.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Source Limitations: Obtain flush wood doors from single manufacturer.

C. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated."

1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.

D. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252.

1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
2. Temperature-Rise Limit: Where indicated provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Deliver doors to building after wet trades have been completed and building is within normal occupancy humidity conditions. Deliver doors in manufacturer's individual original unopened protective materials, clearly marked with manufacturer's name and identifying symbol on covering.

C. Store doors flat with protective coverings provided to protect surfaces. Doors shall not be dragged over one another.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Coordination:

1. The Contractor shall provide door manufacturer with approved hardware schedules, templates and hand for all doors. Contractor shall advise door manufacturer of any changes after information has been forwarded. Contractor will be completely responsible for coordination between hardware, door and frame manufacturers;
2. Door manufacturer shall be responsible for properly coordinating information received by him, so that doors are properly finished, machined and ready to hang.

1.7 WARRANTY

C. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
   b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Algoma Hardwoods, Inc.
2. Eggers Industries.
3. Graham Manufacturing, Corp.

4. Marshfield Door Systems, Inc..
5. Weyerhauser Architectural Doors.

2.2 DOOR CONSTRUCTION, GENERAL

A. Particleboard-Core Doors:

1. Particleboard: ANSI A208.1, Grade LD-1, made with binder containing no urea-formaldehyde resin.
2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware as follows:

    a. 5-inch top-rail blocking, in doors indicated to have closers.
    b. 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
    c. 5-inch midrail blocking, in doors indicated to have exit devices.

B. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
1. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.

C. Mineral-Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware as follows:

    a. 5-inch top and bottom rail blocking.
    b. 4-1/2-by-10-inch lock blocks
    c. 5-inch midrail blocking, in doors indicated to have exit devices.

3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

D. Thickness: All doors shall be 1-3/4 inch thick unless noted otherwise.

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Premium, with Grade AA faces.
2. Species: Red Oak
3. Cut: Plain sliced (flat sliced).

4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: Running match.
6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
7. Exposed Vertical and Top Edges: Same species as faces**.**
8. Core: Particleboard.
9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering.

2.4 LOUVERS AND LIGHT FRAMES

A. Metal Louvers:

1. Blade Type: Vision-proof, inverted V
2. Material: Hot-dip galvanized steel, 18 gauge frame, and 22 louver blades.
3. Finish: Baked-enamel.
4. Free Air Flow: 60 % free area.

B. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads as follows unless otherwise indicated.

1. Wood Species: Same species as door faces.
2. Profile: Flush rectangular beads.
3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.

C. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with requirements in NFPA 80 for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of doors same as door stiles.

D. Openings: Cut and trim openings through doors in factory.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 08 Section "Glazing."
3. Louvers: Factory install louvers in prepared openings.

2.6 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.

B. Finish doors at factory.

C. Transparent Finish:

1. Grade: Premium.
2. Finish: WDMA TR-6 catalyzed polyurethane.
3. Staining: As selected by Architect from manufacturer's full range.
4. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Division 08 Section "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.

a. Comply with NFPA 80 for fire-rated doors.

2. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
3. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock edge; trim stiles and rails only to extent permitted by labeling agency.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 1416

SECTION 08.1816 - SLIDING ALUMINUM-FRAMED GLASS DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior sliding aluminum-framed glass doors.

B. Related Requirements:

1. Section 08.4110 "Aluminum-Framed Entrances and Storefronts" for coordinating finish among aluminum fenestration units on the building exterior.
2. Section 08.7100 "Door Hardware" and Section 08.0671 "Door Hardware Schedule" for hardware not specified in Section 08.1816.13.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.

B. Shop Drawings: For sliding aluminum-framed glass doors.

1. Indicate system component sizes, dimensions and framing R.O., configuration, sliding and swing panels, direction of swing, stacking layout, typical head jamb, side jambs and sill details, type of glazing material, handle height and field measurements.
2. Detail attachments to other work, and between units, if any.
3. Include hardware and required clearances.

C. Samples: For each exposed product and for each color specified, 12-inch-long (300-mm-long) section with weather stripping, glazing bead, and factory-applied color finish.

D. Samples for Selection: For each type of sliding aluminum-framed glass door indicated.

1. Include Samples of hardware and accessories involving color selection.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility: Furnish Sliding Glass Storefront system materials from one manufacturer for entire Project.

B. Manufacturer Qualifications: Manufacturer capable of providing complete, precision built, engineered, pre-fitted units with a minimum thirty (30) years' experience in the sale of folding-sliding door systems for large openings.
   1. Manufacturer to have ISO 9001: 2015 quality management system registration.
   2. Manufacturer to have ISO 14001: 2015 environmental management system registration.

C. Installer Qualifications: Installer experienced in the installation of manufacturer's products or other similar products for large openings. Installer to provide reference list of at least three (3) projects of similar scale and complexity successfully completed in the last three (3) years.
   1. Installer to be trained and certified by manufacturer.

D. Product Test Reports: For each sliding aluminum-framed glass door, for tests performed by **a** qualified testing agency, and for each class and performance grade indicated, tested at AAMA gateway size.

E. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes, weather stripping, operable panels, and operating hardware to include in maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's instructions and recommendations, Section 01 60 00 requirements, and as follows:
   1. Deliver materials to job site in sealed, unopened cartons or crates.
      a. Upon receipt, inspect the shipment to ensure it is complete, in good condition and meets project requirements.
   2. Do not use forced heat to dry out building.
   3. Store material in a well-ventilated area out of direct sunlight under cover in a clean and dry location, protecting units against weather and defacement or damage from construction activities, especially to the edges of panels.

1.7 FIELD CONDITIONS

A. Field Measurements: Contractor to field verify dimensions of rough openings (R.O.), stack storage area, floor bolt socket locations and threshold depressions to receive sill. Mark field measurements on product drawing submittal.

1.8 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of sliding aluminum-framed glass doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.
b. Structural failures including excessive deflection.
c. Excessive water leakage or air infiltration.
d. Faulty operation of movable panels and hardware.
e. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
f. Failure of insulating glass.

2. Warranty Period:

a. Sliding Door and Rollers: 10 years from date of Substantial Completion.
b. Insulating-Glass Units: 10 years from date of Substantial Completion.
c. Aluminum Finish: 10 years from date of Substantial Completion.
d. All other components: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product by Manufacturer: NanaWall HSW60 by NANA WALL SYSTEMS, INC. (www.nanawall.com)
1. 100 Meadow Creek Drive, Corte Madera, CA 94925
2. Toll Free (800) 873-5673

B. Source Limitations: Obtain sliding aluminum-framed glass doors from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Product Certification: AAMA certified with label attached to each door.

B. Thermal Transmittance: NFRC 100 maximum total fenestration product U-factor of 0.32 Btu/sq. ft. x h x deg F (1.83 W/sq. m x K).

C. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum total fenestration product SHGC of 0.40.

D. Thermal Movements: Provide sliding aluminum-framed glass doors, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient.

E. Sound Transmission Class (STC): Rated for not less than **32** STC when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E413.

2.3 EXTERIOR SLIDING ALUMINUM-FRAMED GLASS DOORS

A. Thermally Improved Construction: Fabricate frames and door panels with an integral, concealed, low-conductance thermal barrier located between exterior and interior surfaces in a manner that eliminates direct metal-to-metal contact. Comply with AAMA/WDMA/CSA 101/I.S.2/A440.

1. Panels: Single lite.
   a. Size: As indicated on the Drawings.
   b. Rail Depth: 2-5/16 inch (59 mm)
   c. Top Rail Width: 4-5/16 inch (110 mm)
   d. Bottom Rail: Standard 2-3/8 inch (60 mm) for sliding panel and 4-5/16 inch (110 mm) for swing panel.

2. Frames:
   a. Top Track Depth: 3-1/8 inch (80 mm)
   b. Top Track Width: 4-3/8 inch (111 mm)
   c. Side Jambs Width: 1-9/16 inch (40 mm)

3. Sill Type & Finish:
   a. Low-Profile Floor Track: ADA-ABA compliant
   b. Thickness: 0.078 inch (2.0 mm) nominal
   c. Aluminum Extrusion: AlMgSi0.5 alloy, 6063-T5; F-22 - European standard.
   d. Thermal Break: 3/4 to 15/16 inch (20 to 24 mm) wide polyamide plastic reinforced with glass fibers. Thinner or poured and de-bridged type thermal breaks not acceptable.

4. Panel and Frame Aluminum Finish: One color inside and outside. (AAMA 611 – Anodized).
   a. Finish Type: Select from manufacturer's full range of colors.

5. Glass and Glazing: Manufacturer's standard glazing system that produces weathertight seal. Comply with requirements indicated in Section 08.8000 "Glazing."
   a. Safety Glazing: In compliance with ASTM C1036, ASTM C1048, ANSI Z97.1 and CPSC 16CFR 1201.

6. Hardware General: Provide manufacturer's standard hardware, fabricated from a corrosion-resistant material compatible with aluminum complying with AAMA 907 and designed to smoothly operate, tightly close, and securely lock sliding aluminum-framed glass doors.
   a. Main Entry Panel(s) for Models WITH a Pair of Swing Panel(s):
      1) Rods to be concealed and not edge mounted.
      2) Operation: After turn of key or thumb-turn, depression of handles withdraws latch. Lifting of handles engages rods and turn of key or thumb turn engages deadbolt and operates lock.
      3) Standard lockset handles with a lockable latch.
      4) Multi-point locking with concealed dead bolt and rods at the top and bottom on primary panel only.
      5) Locking: manufacturer's keyed cylinder lock and multipoint locking device on each movable panel, lockable from the inside and outside. Adjust locking device to allow unobstructed movement of the panel across adjacent panel in the direction indicated. Coordinate with Owner's Master Key System.

   b. Door Pulls: Provide manufacturer's standard pull.
      1) Color and Finish: As selected by Architect from manufacturer's full range.
      2) Handle Height: Height of 41-3/8 inch (105 cm) centered from bottom of panel.
   c. Aluminum locking rods with fiberglass reinforced polyamide end caps at the bottom (and top on certain panels). Rods Stroke: 15/16 inch (24 mm).

7. Incorporated Swing Panel (HSW60):
   a. Provide crank handle with pole to be stored in flap on panel stile to convert sliding panel to a swing panel and vice versa.
   b. Provide polyamide conversion box located on upper arm of top rail and circular cover profile located on pivot side of upper arm of top rail.
   c. Swing Door Attachment: Geared positive attachment only to affix swing door to the frame for incorporated swing doors for ease of operation and rigid security.
   d. Pinch Resistance: Provide rounded extrusions on pivot side of incorporated swing panels.

8. Sliding-Swinging Hardware: Provide manufacturer's standard hardware.

a. For each sliding panel, provide two (2) two-three wheeled, sintered bronze (oil impregnated) unidirectional sliding panel carriers with a one wheeled, polyamide guide rollers that are attached to the panels with stainless steel rods.
b. Maximum carrying capacity of two carriers on a panel to be 330 lbs. (150 kgs).
c. Provide on all four corners of sliding panels and incorporated swing panels, thermally broken, die cast zinc multifunctional corner fittings with carrier connectors, male and female locking receptacles, hinges, and hinge pins as required.
d. Finish: Powder coated, closest match to finish of frame and panels.
e. Adjustment: Provide system capable of specified amount of adjustments without removing panels from tracks.

9. Weather stripping: Manufacturer's double layer EPDM between panels and EPDM gasket, or brush seal between panel and frame, or brush seals with a two-layer fiberglass reinforced polyamide fin attached at both inner and outer edge of bottom of door panels with a recessed sill or on frame for sealing between panels and between panel and frame.
   a. Provide UniverSILL®: For outswing low profile saddle sill, and UniverSILL sill adaptor.

10. Fasteners: Stainless steel machine screws for connecting frame components.

2.4 ACCESSORIES

A. Fasteners: Noncorrosive and compatible with door members, trim, hardware, anchors, and other components.

   1. Exposed Fasteners: Do not use exposed fasteners to the greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

B. Anchors, Clips, and Accessories: Provide anchors, clips, and accessories of aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron for sliding aluminum-framed glass doors, complying with ASTM B456 or ASTM B633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

   1. Windborne-Debris Resistance: Provide anchors of same design used in windborne-debris resistance testing.

2.5 FABRICATION

A. Fabricate sliding aluminum-framed glass doors in sizes indicated. Include a complete system for assembling components and anchoring doors.

B. Fabricate sliding aluminum-framed glass doors that are reglazable without dismantling panel framing.

C. Weather Stripping: Provide full-perimeter weather stripping for each door panel.

D. Weep Holes: Provide weep holes and internal drainage passages to conduct infiltrating water to exterior.

E. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

F. Factory-Glazed Fabrication: Glaze sliding aluminum-framed glass doors in the factory where practical and possible for applications indicated. Comply with requirements in Section 08.8000 "Glazing" and with AAMA/WDMA/CSA 101/I.S.2/A440.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

1. Color: Dark Bronze or Black As selected by Architect from full range of industry colors and color densities.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of threshold substrate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight sliding aluminum-framed glass door installation.

D. Verify the structural integrity of the header for deflection with live and dead loads limited to the lesser of L/720 of the span or 1/4 inch (6 mm).

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing doors, hardware, accessories, and other components.

B. Install sliding aluminum-framed glass doors level, plumb, square, true to line, without distortion, without warp or rack of frames and panels, and without impeding thermal movement; anchored securely in place to structural support; and in proper relation to wall flashing, vapor retarders, air barriers, water/weather barriers, and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, to provide weathertight construction.

D. Install sliding aluminum-framed glass doors and components to drain condensation, water penetrating joints, and moisture migrating within doors to the exterior.

E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

F. Install panels, handles, lock set, screens, weather stripping and other accessories in accordance with manufacturer’s recommendations and instructions.

3.3 FIELD QUALITY CONTROL

A. Verify the Sliding Glass Storefront system operates and functions properly. Adjust hardware for proper operation.

B. Non-Conforming Work: Repair or replace non-conforming work as directed by the Architect; see General and Supplementary Conditions, and Division 01, General Requirements.

3.4 ADJUSTING, CLEANING, AND PROTECTION

A. Keep units closed and protect Sliding Glass Storefront installation against damage from construction activities.

B. Remove protective coatings and use manufacturer recommended methods to clean exposed surfaces.

C. Lubricate hardware and moving parts.

D. Adjust operating panels and screens to provide a tight fit at contact points and weather stripping for smooth operation, without binding, and a weathertight closure. Adjust hardware for proper alignment, smooth operation, and proper latching without unnecessary force or excessive clearance.

E. Clean exposed surfaces immediately after installing sliding aluminum-framed glass doors. Avoid damaging protective coatings and finishes. Remove nonpermanent labels, excess sealants, glazing materials, dirt, and other substances.

F. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

G. Protect sliding aluminum-framed glass door surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances contact sliding aluminum-framed glass door surfaces, remove contaminants immediately according to manufacturer's written instructions.

H. Refinish or replace sliding aluminum-framed glass doors with damaged finishes.

I. Replace damaged components.

END OF SECTION 08.1816

SECTION 08.3513 – FOUR-FOLD PANEL DOOR SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes Four-Fold metal doors with surface mounted tube frames.

B. Operation of Four-Fold metal doors includes overhead mounted electro-mechanical operators.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of product specified consisting of manufacturer's technical Product Data and installation instructions for each type of door required, including data substantiating that products comply with requirements.

C. Submittal Drawings showing fabrication and installation of Four-Fold metal doors including plans, elevations, sections, details of components, hardware, operating mechanism, and attachments to the other units of Work. Include wiring diagrams for coordination with electrical trade.

D. Reference list including (5) successful installations of this type of door within the past two (2) years.

1.4 QUALITY ASSURANCE

A. Doors shall be designed to withstand external or internal horizontal wind loads of 120 mph (3 second gust) per ASCE 7-16. The maximum allowable deflection shall not exceed 1/120 of the span. Fiber stresses in main members shall be limited to 27,000 pounds per square inch. Steel frames shall be designed in accordance with the AISC "Steel Construction Manual".

B. Door manufacturer shall have at least 10 years experience in manufacturing door type specified.

1.5 DELIVERY, STORAGE AND HANDLING

A. Store delivered materials and equipment in dry locations with adequate ventilation, free from dust and water, and so as to permit access for inspection and handling.

B. Handle materials carefully to prevent damage.

1.6 WARRANTY

A. The door manufacturer shall provide a written standard limited warranty for material and workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Four-Fold industrial metal doors manufactured by Door Engineering and Manufacturing, 101 Power Dr, Mankato, MN 56001, (800)-959-1352 or equal products by other manufacturers approved in advance. https://www.doorengineering.com/products/commercial-industrial
   a. Basis of design model: FF300 Series: Glazed

B. Acceptable manufactures meeting the requirements as indicated in specifications
   a. Overhead Door – Mid-Atlantic Door Group inc.: https://www.overheaddoors.com/contact-us/
   b. Clear Fold: https://www.clearfold.com/portfolio/fire-station-doors/
   c. Electric Power Door: https://www.electricpowerdoor.com/products/four-fold-doors/
   d. Jewers: https://www.jewersdoors.co.uk/jewers-doors-nc.html

2.2 MATERIALS

A. Steel Tube: ASTM A513 and ASTM A500/A500M

B. Steel Sheets: Steel sheets of commercial quality, complying with ASTM A1008 cold-rolled steel sheet.

C. Hardware: Manufacturer's standard components.

D. Fasteners: Zinc-coated steel.

2.3 FOUR-FOLD DOORS

A. Construction: Door framing shall be minimum 11-gauge structural steel tube with 14-gauge steel sheet on the exterior and interior faces. Sheeting shall be formed on the vertical edges with no visible welds on the interior or exterior panel faces. All frames and framing members shall be true to dimension and square in all directions, and no door shall be bowed, warped, or out of line, in the vertical or horizontal plane of the door opening by more than 1/8 inch in 20 feet. Exposed welds and welds which interfere with the installation of various parts shall be ground smooth and flush.

B. Surface Mounted Tube Frame: Supply pre-hung tube frame system constructed of minimum TS6x4x3/16", designed to anchor to masonry wall construction or weld to steel structure. All hinges, track supports and operator supports shall be factory attached.

C. Factory finish: Door Panels and Tube Frames shall be finished with manufacturer's standard PPG Spectracron epoxy primer and polyurethane top coat. Custom color to match RAL # as selected by Architect.

1. Operator and operating hardware shall be powder-coated manufacturer's standard gray.

D. Hardware: Hardware shall include guide tracks and brackets, trolleys, center guides, not less than three pairs of jamb and fold hinges per opening, and all bolts, nuts, fasteners, etc. necessary for complete installation and operation.

1. All hardware, including hinges and trolleys, shall be bolted to the panel for easy removal for service or panel replacement.

2. Doors up to 16' wide and under 30psf windload shall require no floor mounted supports, guides or tracks.

3. Top tracks shall be adjustable on the end track hangers to allow for adjustment of the door panels in the open position and easily replaceable without removal of the door framing or operators.

E. Hinges: Jamb hinges shall be dual shear and have two thrust bearings and two needle bearings. Fold hinges shall be stainless steel and be dual shear with two thrust bearings. All bearings shall be completely concealed within the hinge barrel and include grease zerks. All hinge pins shall be minimum ¾" diameter hardened steel.

F. Hinge Guards: Provide plastic guards at jamb hinges to prevent access through hinge space.

G. Weatherstripping: Material shall be adjustable and readily replaceable and provide a substantially weather-tight installation. Weatherstripping at center shall be 1/16" cloth inserted neoprene and include no exposed fasteners on the exterior face of the panel. Weatherstripping at sill shall include two 1/16" cloth inserted neoprene sweeps with an aluminum retainer. The retainer shall be attached to the door with adhesive.

H. Perimeter Weatherstripping: Provide jamb and head weatherstripping of 1/16" cloth-inserted neoprene bulb (or closed cell neoprene).

I. Vision Panels: Provide 1" insulated, tempered, vision panels of the size, shape and location as detailed and noted on the drawings.

2.4 OPERATOR

A. Each Four-Fold door shall be operated by an overhead mounted electro-mechanical drive unit designed for high cycle operation. Operator consists of an electric motor, gear reducer, and rotating drive arm. The door shall be operated with connecting rods attached to the rotating drive arm on the operator and to control arms attached to the jamb door section and to the door lintel. The connecting rods shall be positive drive, keeping the door under firm control at all times. The connecting rods shall be fitted with spherical bearings and control arms shall be equipped with oil impregnated bronze bearings on polished shafts.

B. Operator shall be instantly reversible, open and close rapidly and start and stop gradually. Operator shall be adjustable to allow door to fully clear the opening. Operator shall automatically lock the door in the closed position. Operator shall be equipped with disengaging mechanism to convert to manual operation.

C. Electric motor shall be of sufficient size to operate doors under normal operating conditions at no more than 75 percent of rated capacity. The motor shall be wound for three phase 208/230/480 VAC, 60 Hertz operation.

D. Electric Controls: Controls shall be furnished by the door manufacturer and shall be complete for each door, and built-in accordance with the latest NEMA standards. Incoming electrical shall be 208/230VAC 3-phase – see electrical drawings.

1. Control panel assemblies shall be UL listed as per NFPA70.

2. Controls shall include a programmable logic controller with digital message display. Controller shall include programmable close timers and programmable inputs/outputs.

3. Controls shall include a variable frequency drive with independent adjustment of the opening and closing speeds.

4. Enclosures shall be NEMA 4 with disconnect switch.

5. Pushbuttons (interior) for each door shall have one (1) momentary pressure three-button push-button station marked “OPEN”, “CLOSE” and “STOP”. Push button enclosure shall be NEMA 4.

6. Limit switches shall be provided to stop the travel of the door in its fully open or fully closed position.

7. Safety edges: Provide monitored electric safety edges on leading edge of all doors to reverse door upon contact with obstruction.

8. Photo eyes: Provide (1) exterior, jamb mounted, light Curtain type photo eyes, NEMA 4 rated. Photo eye shall cover from floor level to 72” above floor.

9. Presence Sensor: Provide (1) interior, overhead mounted, presence sensor BEA IS40P or equal. Doors over 16’ tall shall include LZR-Widescan or equal.

10. Radio controls: Provide one (1) radio receiver and (1) single button remotes per door. Remotes to open and close doors with single button.

11. Timer Activation Loop Detectors (fire station applications): Provide "pulse on exit type" loop detector to activate auto close timer once loop has been activated and cleared, include hand/auto switch to deactivate timer. G.C. to coordinate installation of preformed loop with installer prior to exterior apron being poured.

12. Warning Horn/Strobe: Provide warning light and strobe. Include outputs PLC to allow for activation while door is in motion both opening and closing, along with activation prior to closing. Include programmable "delay-to-close" timer which activates the warning horn for a set time, prior to the door closing.

13. Wiring: Door manufacturer shall supply controls and components only. Electrical contractor shall install controls and furnish and install conduits and wiring for jobsite power and control wiring.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install Four-Fold metal doors in strict accordance with the approved drawings by qualified door erection crews. All door openings shall be completely prepared by the general contractor prior to the installation of the doors. Permanent or temporary electric wiring shall be brought to the door opening before installation is started and shall be completed so as not to delay the inspection test.

B. Doors shall be set plumb, level, and square, and with all parts properly fastened and mounted. All moving parts shall be tested and adjusted and left in good operating condition.

3.2 ADJUSTING AND CLEANING

A. Inspection of the doors and a complete operating test will be made by the installer in the presence of the general contractor or architect as soon as the erection is complete. Any defects noted shall be corrected. After door approval in the above test, the general contractor must assume the responsibility for any damage or rough handling of the doors during construction until the building is turned over to the owner and final inspection is made.

B. Clean surfaces and repaint abraded or damaged finished surfaces to match factory-applied finish.

END OF SECTION 08.3513

SECTION 08.3613 – OVERHEAD SECTIONAL DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Glazed Aluminum Sectional Overhead Doors
B. Insulated Sectional Overhead Doors
C. Electric Operators and Controls.
D. Operating Hardware, tracks, and support.

1.2 RELATED SECTIONS

A. Section 03.3000 - Cast-In-Place Concrete: Prepared opening in concrete. Execution requirements for placement of anchors in concrete wall construction.

B. Section 04.2000 - Unit Masonry: Prepared opening in masonry. Execution requirements for placement of anchors in masonry wall construction.

C. Section 05.5000 - Metal Fabrications: Steel frame and supports.

D. Section 06.1053 – Miscellaneous Rough Carpentry: Rough wood framing and blocking for door opening.

E. Section 07.9200 - Joint Sealers: Perimeter sealant and backup materials.

F. Section 08.7100 - Door Hardware: Cylinder locks.

G. Section 09.9100 - Painting: Field painting.

H. Section 16.0150 - Wiring Connections: Electrical service to door operator.

1.3 REFERENCES

A. ANSI/DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors.

1.4 DESIGN / PERFORMANCE REQUIREMENTS

A. Wind Loads: Design and size components to withstand loads caused by pressure and suction of wind acting normal to plane of wall as calculated in accordance with applicable code.
1. Design pressure as indicated on the Drawings.

B. Wiring Connections: Requirements for electrical characteristics.
   1. 230 volts, three phase, 60 Hz.

C. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

1.5 SUBMITTALS

A. Submit under provisions of Section 01.3000.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: Indicate plans and elevations including opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.

D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

E. Operation and Maintenance Data.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

B. Installer Qualifications: Authorized representative of the manufacturer with minimum five years documented experience.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to authority having jurisdiction as suitable for purpose specified.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened labeled packaging until ready for installation.

B. Protect materials from exposure to moisture until ready for installation.

C. Store materials in a dry, ventilated weathertight location.

1.8 PROJECT CONDITIONS

A. Pre-Installation Conference: Convene a pre-installation conference just prior to commencement of field operations, to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Overhead Door Corp., 2501 S. State Hwy. 121, Suite 200, Lewisville, TX 75067. ASD. Tel. Toll Free: (800) 275-3290. Phone: (469) 549-7100. Fax: (972) 906-1499. Web Site: www.overheaddoor.com. E-mail: sales@overheaddoor.com.

B. Acceptable Manufactures:
1. Assa Abloy Entrance Systems
2. Industrial Door Solutions
3. Wayne-Dalton
4. American Garage Door Supply Inc.

C. Requests for substitutions will be considered in accordance with provisions of Section 01.6000.

2.2 GLAZED ALUMINUM SECTIONAL OVERHEAD DOORS

A. Glazed Sectional Overhead Doors: 521 Series Aluminum Doors by Overhead Door Corporation.
1. Door Assembly: Stile and rail assembly secured with 1/4 inch (6 mm) diameter through rods.
   a. Panel Thickness: 1-3/4 inches (44 mm).
   b. Center Stile Width: 2-11/16 inches (68 mm)
   c. End Stile Width: 3-5/16 inches (84 mm)
   d. Intermediate Rail Pair Width: 3-11/16 inches (94 mm).
   e. Top Rail Width:
      1) 3-3/4 inches (95 mm).
   f. Bottom Rail Width:
      1) 3-3/4 inches (95 mm).
   g. Aluminum Panels: 0.050 inch (1.3 mm) thick, aluminum.
   h. Stiles and Rails: 6063 - T6 aluminum.
   i. Springs:
      1) 100,000 cycles.
   j. Glazing:

1) 1/2 inch (12.5 mm) Low E tempered Insulated glazing.
2) 1/2 inch (12.5 mm) Obscure tempered Insulated glazing.

2. Finish and Color:
   a. Powder Coating Finish: Custom Color as selected by Architect to match RAL # to be determined.
3. Windload Design: Provide to meet the Design/Performance requirements specified.
4. Hardware: Galvanized steel hinges and fixtures. Ball bearing rollers with hardened steel races.
5. Lock: Interior galvanized single unit.
6. Weatherstripping:
   a. Flexible bulb-type strip at bottom section.
   b. Flexible Jamb seals.
   c. Flexible Header seal.
7. Track: Provide Full vertical track.
8. Electric Motor Operation: Provide UL listed electric operator, size and type as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second. Operator shall meet UL325/2010 requirements for continuous monitoring of safety devices.
   a. Entrapment Protection: Required for momentary contact, includes radio control operation.
      1) Pneumatic sensing edge up to 18 feet (5.5 m) wide. Constant contact only complying with UL 325/2010.
   b. Operator Controls:
      1) Push-button operated control stations with open, close, and stop buttons.
      2) Surface mounting.
      3) Interior location.
   c. Special Operation:
      1) Pull switch.
      2) Vehicle detector operation.
      3) Commercial light package.
      4) Explosion and dust ignition proof control wiring.

2.3 INSULATED SECTIONAL OVERHEAD DOORS

A. Insulated Steel Sectional Overhead Doors: 470 Series Insulated Steel Doors by Overhead Door Corporation. Units shall have the following characteristics:
1. Door Assembly: Rigid steel construction; fully insulated on the inside face with continuous steel backing on the inside face. Fabricated with steel end stiles and tongue and groove sections.
   a. Panel Thickness: 2 inches (51 mm).
   b. Exterior Surface: Ribbed.

c. Exterior Steel: 26 gauge, hot-dipped galvanized with an embossed simulated wood grain texture.
d. Interior Steel: 29 gauge, hot-dipped galvanized
e. Springs:
    1) 100,000 cycles.
f. Insulation: Polystyrene.
g. Thermal Values:
    1) Polystyrene - R-value of 9.83; U-value of 0.102.
h. Partial Glazing of Steel Panels:
    1) 19 inch by 12 inch window.
        (a) Tempered Glass

2. Finish and Color: Two coat baked-on polyester. Color as follows:
    a. Custom Color as selected by Architect to match RAL #
3. Windload Design: Provide to meet the Design/Performance requirements specified.
4. Hardware: Galvanized steel hinges and fixtures. Ball bearing rollers with hardened steel races.
5. Lock:
    a. Keyed lock with interlock switch for automatic operator.
    b. Locking mechanism designed to maintain security for exterior while permitting break out when impacted from the inside.
6. Weatherstripping:
    a. Flexible bulb-type strip at bottom section.
    b. Flexible Jamb seals.
    c. Flexible Header seal.
7. Track: Provide Full Vertical track
8. Electric Motor Operation: Provide UL listed electric operator, size and type as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second. Operator shall meet UL325/2010 requirements for continuous monitoring of safety devices.
    a. Entrapment Protection: Required for momentary contact, includes radio control operation.
        1) Pneumatic sensing edge up to 18 feet (5.5 m) wide. Constant contact only complying with UL 325/2010.
    b. Operator Controls:
        1) Push-button operated control stations with open, close, and stop buttons.
        2) Surface mounting.
        3) Interior location.
    c. Special Operation:
        1) Pull switch.
        2) Vehicle detector operation.
        3) Door timer operation.
        4) Commercial light package.

5) Explosion and dust ignition proof control wiring.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until openings have been properly prepared.

B. Verify wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.

C. Verify electric power is available and of correct characteristics.

D. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install overhead doors and track in accordance with approved shop drawings and the manufacturer's printed instructions.

B. Coordinate installation with adjacent work to ensure proper clearances and allow for maintenance.

C. Anchor assembly to wall construction and building framing without distortion or stress.

D. Securely brace door tracks suspended from structure. Secure tracks to structural members only.

E. Fit and align door assembly including hardware.

F. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

3.4 CLEANING AND ADJUSTING

A. Adjust door assembly to smooth operation and in full contact with weatherstripping.

B. Clean doors, frames and glass.

C. Remove temporary labels and visible markings.

3.5 PROTECTION

A. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

B. Protect installed products until completion of project.

C. Touch-up, damaged coatings and finishes and repair minor damage before Substantial Completion.

END OF SECTION 08.3613

SECTION 08.4110 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Exterior and interior storefront framing.
2. Storefront framing for window walls.
3. Storefront framing for punched openings.
4. Exterior and interior manual-swing entrance doors and door-frame units.
5. Venting windows.

1.3 DEFINITIONS

A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:

1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
2. Dimensional tolerances of building frame and other adjacent construction.
3. Failure includes the following:

a. Deflection exceeding specified limits.
b. Thermal stresses transferring to building structure.
c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
d. Glazing-to-glazing contact.
e. Noise or vibration created by wind and by thermal and structural movements.
f. Loosening or weakening of fasteners, attachments, and other components.
g. Sealant failure.
h. Failure of operating units.

B. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft.of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft.

C. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

D. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
2. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

E. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 60 when tested according to AAMA 1503.

F. Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor of not more than 0.57 Btu/sq. ft. x h x deg F when tested according to AAMA 1503.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.

B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.

1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.

E. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

F. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.

C. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

D. Accessible Entrances: Comply with applicable provisions in ICC/ANSI A117.1.

E. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

F. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

B. Hardware: Contractor shall provide this subcontractor with approved hardware information and template drawings for doors to be installed in aluminum frames. Contractor will be completely responsible for coordination between the hardware supplier and this subcontractor.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including, but not limited to, excessive deflection.
   b. Noise or vibration caused by thermal movements.
   c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   d. Adhesive or cohesive sealant failures.

e. Water leakage through fixed glazing and framing areas.
f. Failure of operating components.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01.4000 "Quality Requirements," to design aluminum-framed entrances and storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:
   a. Thermal stresses transferring to building structure.
   b. Glass breakage.
   c. Noise or vibration created by wind and thermal and structural movements.
   d. Loosening or weakening of fasteners, attachments, and other components.
   e. Failure of operating units.

C. Structural Loads:
1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.

D. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.
   a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:

a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4 inch for spans greater than 11 feet 8-1/4 inches or 1/175 times span, for spans less than 11 feet 8-1/4 inches.

E. Structural: Test according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:

1. Fixed Framing and Glass Area:

a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft.

2. Entrance Doors:

a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
b. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.

G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

H. Water Penetration under Dynamic Pressure: Test according to AAMA 501.1 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
2. Maximum Water Leakage: No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.

I. Interstory Drift: Accommodate design displacement of adjacent stories indicated.

1. Design Displacement: As indicated on Drawings.
2. Test Performance: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.4 at design displacement and 1.5 times the design displacement.

J. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.6 at design displacement and 1.5 times the design displacement.
2. Vertical Interstory Movement: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.7 at design displacement and 1.5 times the design displacement.

K. Energy Performance: Certify and label energy performance according to NFRC as follows:

1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than the value indicated in the 2009 International Code Council's International Energy Conservation Code for aluminum-framed window systems, entrance doors, and windows.
2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.40 as determined according to NFRC 200.
3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 45 as determined according to NFRC 500.

L. Noise Reduction: Test according to ASTM E 90, with ratings determined by ASTM E 1332, as follows.

1. Outdoor-Indoor Transmission Class: Minimum 26.

M. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

    a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
    b. Low Exterior Ambient-Air Temperature: 0 deg F.
    c. Interior Ambient-Air Temperature: 75 deg F.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Kawneer North America; an Alcoa company Trifab VG 451T (Basis of Design)
2. EFCO Corporation.
3. Tubelite.
4. Vistawall Architectural Products; The Vistawall Group; a Bluescope Steel company.
5. YKK AP America Inc.

2.3 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken for exterior applications, non-thermal for interior applications.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: As indicated

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system, fabricated from stainless steel.

D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts, complying with ASTM A 123/A 123M or ASTM A 153/A 153M.

E. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.

1. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 GLAZING SYSTEMS

A. Glazing: Comply with Section 08.8000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

2.6 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.

1. Door Construction: ***2 1/2 inch minimum thickness***, with minimum 0.188-inchhick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.

2. Door Design: Wide stile; 5-inch nominal width.

a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.

3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

a. Provide non-removable glazing stops on outside of door.

B. Entrance Door Hardware: Prepare for, receive and install finish hardware as specified in Division 08 Section "Finish Hardware."

C. Weather Stripping: Manufacturer's standard replaceable components.

1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.

D. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

E. Silencers: BHMA A156.16, Grade 1.

2.7 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 07 Section "Joint Sealants."

1. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil thickness per coat.

2.8 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from interior.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
1. At exterior doors, provide compression weather stripping at fixed stops.
2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

A. High-Performance Organic Finish: Three-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:
1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure non-movement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
6. Seal joints watertight unless otherwise indicated.

B. Metal Protection:
1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

F. Install glazing as specified in Division 08 Section "Glazing."

G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
   1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
   2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

H. Install perimeter joint sealants as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

3.3 ERECTION TOLERANCES

A. Install aluminum-framed systems to comply with the following maximum erection tolerances:
   1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.
   2. Alignment:
      a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
      b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

3.4 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.
   1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch, measured to the leading door edge.

3.5 CLEANING

A. Immediately prior to acceptance of the work, remove all protective materials and clean all exposed members.

B. Clean with materials free of abrasives or harmful cleaning agents.

3.6 PROTECTION

A. Protect all finished surfaces as necessary to prevent damage during progress of the work.

END OF SECTION 08.4113

SECTION 08.4123 - FIRE RATED ALUMINUM FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Fire rated glazing and framing systems for installation as windows and wall sections in interior openings.

B. Related Sections:
1. Division 8 Section “Aluminum Entrance and Storefronts” for entrance and storefront systems installed with steel fire-rated glazed curtain-wall systems
2. Division 8 Section “Door Hardware:” for hardware for exterior and interior manual-swing door entrances.
3. Section 08.4123 – “Fire Rated Glass And Framing Systems – Fireframes Designer Series” for fire-rated doors.

1.2 REFERENCES

A. American Architectural Manufacturers Association (AAMA)
1. AAMA 2603-2002 Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.

B. American Society for Testing and Materials (ASTM):
1. Fire safety related:
a. ASTM E119: Methods for Fire Tests of Building Construction and Materials.

2. Material related
a. ASTM A 1008/A 1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low Alloy, and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2007.
b. ASTM A 1011/A 1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2006b.
3. Exterior-related:
a. ASTM E 283-04: Test Method for Determining the Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences across the Specimen
b. ASTM E 330-02: Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference Procedure A
c. ASTM E 331-04: Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
d. ASTM E 783-02: Test Method for Field Measurement of Air Leakage through Installed Exterior Windows and Doors

e. ASTM E 1105-00: Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference

C. American Welding Society (AWS)
1. AWS D1.3 - Structural Welding Code - Sheet Steel; 2007

D. Builders Hardware Manufacturers Association, Inc.
1. BHMA A156 - American National Standards for door hardware; 2006 (ANSI/BHMA A156).

E. National Fire Protection Association (NFPA):
1. NFPA 80: Fire Doors and Windows.
2. NFPA 251: Fire Tests of Building Construction & Materials
3. NFPA 252: Fire Tests of Door Assemblies
4. NFPA 257: Fire Test of Window Assemblies

F. Underwriters Laboratories, Inc. (UL):
1. UL 9: Fire Tests of Window Assemblies.
1. UL 10 B: Fire Tests of Door Assemblies
2. UL 10 C: Positive Pressure Fire Tests of Window & Door Assemblies
3. UL 263: Fire tests of Building Construction and Materials

G. American National Standards Institute (ANSI):
1. ANSI Z97.1: Standard for Safety Glazing Materials Used in Buildings

H. Consumer Product Safety Commission (CPSC):
1. CPSC 16 CFR 1201: Safety Standard for Architectural Glazing Materials

I. American Society of Civil Engineers (ASCE)
1. ASCE 7 – Minimum Design Loads for Buildings and Other Structures; 2005

1.3 DEFINITIONS

1. Manufacturer: A firm that produces primary glass, fabricated glass or framing as defined in referenced glazing publications.

1.4 SUBMITTALS

A. Product Data:
1. Technical Information: Submit latest edition of manufacturer's product data providing product descriptions, technical data, Underwriters Laboratories, Inc. listings and installation instructions.

B. Shop Drawings:
1. Include plans, elevations and details of product showing component dimensions; framing opening requirements, dimensions, tolerances, and attachment to structure

C. Structural Calculations:
   1. Provide structural calculations sealed by a licensed professional engineer in the State in which the project is located; prepared in compliance with referenced documents and these specifications.

D. Samples for following products:
   1. 12" x 12" Glass sample provided by manufacturer of each specified glass type.
   2. 6" long sample of frame.
   3. Verification of sample of selected finish.

E. Glazing Schedule: Use same designations indicated on drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

F. Warranties: Submit manufacturer's warranty.

G. Certificates of compliance from glass and glazing materials manufacturers attesting that glass and glazing materials furnished for project comply with requirements.
   1. Separate certification will not be required for glazing materials bearing manufacturer's permanent label designating type and thickness of glass, provided labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authority having jurisdiction

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualifications according to
   1. International Accreditation Service for a Type A Third-Party Inspection Body (Field Services ICC-ES Third-Party Inspections Standard Operating Procedures, 00-BL-S0400 and S0401)
   2. International Accreditation Service for Testing Body-Building Materials and Systems
      a. Fire Testing
         1) ASTM Standards E 119
         2) CPSC Standards 16 CFR 1201
         3) NFPA Standards 251, 252, 257
         4) UL Standards 9, 10B, 10C, 1784, UL Subject 63
         5) BS 476; Part 22: 1987
         6) EN 1634-1

B. Fire-Rated Window Assemblies: Assemblies complying with NFPA 80 that are classified and labeled by UL, for fire ratings indicated, based on testing according to NFPA 257 and UL 9.

C. Fire-Rated Wall Assemblies: Assemblies complying with ASTM E119 that are classified and labeled by UL, for fire ratings indicated, based on testing in accordance with UL 263, ASTM E119.

D. Listings and Labels - Fire Rated Assemblies: Under current follow-up service by Underwriters Laboratories® maintaining a current listing or certification. Label assemblies' accordance with limits of manufacturer's listing.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle under provisions specified by manufacturer.

1.7 PROJECT CONDITIONS

A. Obtain field measurements prior to fabrication of frame units. If field measurements will not be available in a timely manner coordinate planned measurements with the work of other sections.
   1. Note whether field or planned dimensions were used in the creation of the shop drawings.

B. Coordinate the work of this section with others effected including but not limited to: other interior and/or exterior envelope components and door hardware beyond that provided by this section.

1.8 WARRANTY

A. Provide a minimum standard five-year manufacturer warranty.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Fire-Protection-Rated Glazing, General: As specified in Division 08 Section "Glazing"

B. Fire-rated frame system:

   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

      a. "Fireframes Aluminum Series" fire-rated frame system as manufactured and supplied by Technical Glass Products

      b. Aluflam North America: 16604 Edwards Road, Cerritos, CA; Phone: 562.926.95202; web: www.aluflam-usa.com

      c. Kawneer: web: www.kawneer.com

2.2 PERFORMANCE REQUIREMENTS

A. System Description:
   1. Steel fire-rated glazed wall and/or window system, dual aluminum cover cap format
      a. Face widths available:
         1) 2"

      b. Duration – Windows Capable of providing a fire rating for 60 minutes.
      c. Duration – Walls: Capable of providing a fire rating for 60 minutes.

B. Structural Performance

1. Design and size the system to withstand structural forces placed upon it without damage or permanent set when tested in accordance with ASTM E330 using load 1.5 times the design wind loads and of 10 seconds in duration.
2. Member deflection: Limit deflection of the edge of the glass normal to the plane of the glass to 1/175 of the glass edge length or ¾ inch, whichever is less
3. Accommodate movement between storefront and adjoining systems

C. Air Infiltration: ASTM E 283; Air infiltration rate shall not exceed 0.06 cfm/ft2 at a static air pressure differential of 6.24 psf.

D. Water Resistance, (static): ASTM E 331; No leakage at a static air pressure differential of 15 psf as defined in AAMA 501.

2.3 MATERIALS - GLASS

A. Fire Rated Glazing Basis-of-design Products: Subject to compliance with requirements.

B. Impact Safety Resistance: ANSI Z97.1 and CPSC 16CFR1201(Cat. I and II).

C. Properties Interior Glazing

Fire-Rating	45 minute	60 minute		120 minute
Manufacturer's designation	45-200	60-101	60-201	120-106
Glazing type	single	single	single	IGU
Nominal Thickness	3/4" (19mm)	7/8" (23mm)	1-1/16" (27mm)	2-1/4" (57mm)
Weight in lbs/sf	9.2	10.85	12.5	22.9
Daylight Transmission	86	87%	86%	75%
Sound Transmission Coefficient	40dB	41dB	44dB	46dB

D. Logo: Each piece of fire-rated glazing shall be labeled with a permanent logo including name of product, manufacture, testing laboratory (UL), fire rating period, safety glazing standards, and date of manufacture.

E. Glazing Accessories: Manufacturer's standard compression gaskets, standoff, spacers, setting blocks and other accessories necessary for a complete installation.

2.4 MATERIALS –ALUMINUM FRAMES

A. Aluminum Framing System 45 min. & 60 min.
1. Steel Frame — The steel framing members are made of two halves, nom. 1.9 in. wide (48.3 mm) with a nom. minimum depth of 1.38 in. (35 mm) with lengths cut according to glazing size.
2. Aluminum Trim — Supplied with the steel framing members. Nom. 2 in. (50.8 mm) wide with a nom. depth of 1.54 in. (39 mm) with lengths cut according to glazing size.

3. Stainless Steel Standoffs — Supplied with the steel framing members. Nom 5/16 in. (8 mm) diameter with a nom. minimum depth of 1 1/8 in. (28 mm) with depth adjusted to match glazing thickness.
4. Stainless Steel Moment and Connecting Braces: — Supplied with the steel framing members. Nom 3/8 in. (10 mm) thick with a nom. minimum depth of 1 1/8 in. (28 mm) with depth adjusted to match glazing thickness.
5. Framing Member Fasteners — Supplied with the steel framing members. Screws are M6 x16mm Button Head Socket Cap Screws for frame assembly and #6 x 1" Pan Head Sheet Metal Screws for door installation.
6. Glazing Gasket —
   a. Interior Gasketing-Supplied with the steel framing members. Nom. 3/4 in. (19 mm) x 3/16 (4.5 mm) black applied to the steel framing members to cushion and seal the glazing material when installed.
   b. Exterior Gasketing- Supplied with the steel framing members. Nom. 2 in. (50 mm) x 3/16 (4.5 mm) black applied to the steel framing members to cushion and seal the glazing material when installed.

B. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   1. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221 (ASTM B 221M).

C. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
   1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
   2. Cold-Rolled Sheet and Strip: ASTM A 611.
   3. Hot-Rolled Sheet and Strip: ASTM A 570/A 570M.

D. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   1. Where fasteners are subject to loosening or turn out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
   2. Reinforce members as required to receive fastener threads.

2.5 Accessories

A. Fasteners: Use fasteners fabricated from Type 304 or Type 316 stainless steel.

B. Glazing Gaskets:

   1. Glazing gaskets for interior or exterior applications: ASTM C 864 (extruded EPDM rubber that provides for silicone adhesion) or ASTM C1115 Standard Specification for Dense Elastomeric Silicone Rubber Gaskets and Accessories (extruded silicone).

C. Intumescent Tape: As supplied by frame manufacturer.

D. Setting Blocks: ¼" Calcium silicate.

E. Perimeter Anchors: Steel.

F. Flashings: As recommended by manufacturer; same material and finish as cover caps.

G. Silicone Sealant: One-Part Low Modulus, neutral cure High Movement-Capable Sealant: Type S; Grade NS; Class 25 with additional movement capability of 100 percent in extension and 50 percent in compression (total 150 percent); Use (Exposure) NT; Uses (Substrates) M, G, A, and O as applicable. (Use-O joint substrates include: Metal factory-coated with a high-performance coating; galvanized steel; ceramic tile.)

1. Available Products:

a. Dow Corning 790, 795 - Dow Corning Corp.

b. Momentive

c. Tremco

H. Intumescent Caulk: Single component, latex-based, intumescent caulk designed to stop passage of fire, smoke, and fumes through fire-rated separations; permanently flexible after cure; will not support mold growth; flame spread/smoke developed 10/10.

1. Available Products:

a. 3M CP-25 WP+

2.6 SLAG-WOOL-FIBER/ROCK-WOOL-FIBER INSULATION

A. Available Manufacturers:
1. Fibrex Insulations Inc.
2. Owens Corning
3. Thermafiber.
4. Rockwool

B. Unfaced, Slag-Wool-Fiber/Rock-Wool-Fiber Board Insulation: ASTM C 612, maximum flame-spread and smoke-developed indexes of 15 and 0, respectively; passing ASTM E 136 for combustion characteristics; and of the following nominal density and thermal resistivity:

1. Nominal density of 4 lb/cu. ft. (64 kg/cu. m), Types IA and IB, thermal resistivity of 4 deg F x h x sq. ft./Btu x in. at 75 deg F (27.7 K x m/W at 24 deg C).

2. Fiber Color: Regular color, unless otherwise indicated.

2.7 FABRICATION

A. Obtain reviewed shop drawings prior to fabrication.

B. Fabrication Dimensions: Fabricate fire-rated assembly to field dimensions.

C. Factory prepared, fire-rated steel door assemblies to be prehung, prefinished with hardware preinstalled for field mounting.

D. Field glaze door and frame assemblies.

2.8 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish frames after assembly.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable. Noticeable variations in the same piece are not acceptable.

2.9 POWDERCOAT FINISHES

A. Finish after fabrication.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable. Noticeable variations in the same piece are not acceptable.

C. Steel or Aluminum Finishes
1. Powder-Coat Finish: Polyester Super Durable powder coating which meets AAMA 2604 for chalking and fading. Apply manufacturer's standard powder coating finish system applied to factory-assembled frames before shipping, complying with manufacturer's recommended instructions for surface preparation including pretreatment, application, and minimum dry film thickness.
2. Color and Gloss: As selected by Architect from manufacturer's full range.
3. Acceptable Manufacturers:
   a. Tiger Drylac
   b. Additional manufacturers as approved by Aluminum frame manufacturer

D. Aluminum Finishes
1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA [2604] [2605] and with coating and resin manufacturers' written instructions.
3. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions. Verify openings are sized to receive curtain wall system and sill plate is level in accordance with manufacturer's acceptable tolerances.

B. Notify Architect of any conditions which jeopardize the integrity of the proposed fire wall / door system.

C. Do not proceed until such conditions are corrected.

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
6. Seal joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

F. Install glazing as specified in Division 08 Section "Glazing."

3.3 REPAIR AND TOUCH UP

A. Anodized Finishes

1. Protect the anodized finish from harsh chemicals such as concrete/mortar or muriatic acid/brick wash. If reasonable care is taken during handling and high and low pH chemicals can be avoided, repair and/or touch-up of an anodize finish will not be needed.
2. Some rub marks on an anodized surface can be removed with a mild abrasive pad such as a Scotch-Brite pad prior to touch up painting.
3. Touch-up paint should be used even more sparingly over anodize. Only the visible raw aluminum in the scratch or gouge should be touched up with a matching paint.

B. Powder Coated Finishes

1. Limited to minor repair of small scratches. Use only manufacturer's recommended products.

2. Such repairs shall match original finish for quality or material and view.

3. Repairs and touch-up not visible from a distance of 5 feet Owner and Architect to approve.

C. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged.

3.4 PROTECTION AND CLEANING

A. Protect glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
1. Do not clean with astringent cleaners. Use a clean "grit free" cloth and a small amount of mild soap and water or mild detergent.
2. Do not use any of the following:
   a. Steam jets
   b. Abrasives
   c. Strong acidic or alkaline detergents, or surface-reactive agents
   d. Detergents not recommended in writing by the manufacturer
   e. Do not use any detergent above 77 degrees F
   f. Organic solvents including but not limited to those containing ester, ketones, alcohols, aromatic compounds, glycol ether, or halogenated hydrocarbons.
   g. Metal or hard parts of cleaning equipment must not touch the glass surface

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

END OF SECTION 08.4123

SECTION 08.4413 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes glazed aluminum curtain walls.

B. Related Requirements:
1. Division 07 Section “Joint Sealants” for installation of joint sealants installed with glazed aluminum curtain walls and for sealants to the extent not specified in this Section
2. Division 08 Section “Glazing” for glazing installed with glazed aluminum curtain walls.
3. Division 08 Section “Aluminum Entrances and Storefront.”

1.3 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For glazed aluminum curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:

a. Joinery, including concealed welds.
b. Anchorage.
c. Expansion provisions.
d. Glazing.
e. Flashing and drainage.

3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

E. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

F. Delegated-Design Submittal: For glazed aluminum curtain walls indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

G. Qualification Data: For Installer.

H. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components from manufacturer.

1. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.

I. Product Test Reports: For glazed aluminum curtain walls, for tests performed by a qualified testing agency.

J. Field quality-control reports.

K. Warranties: Sample of special warranties.

L. Maintenance Data: For glazed aluminum curtain walls to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating glazed aluminum curtain walls that meet or exceed energy performance requirements indicated and of documenting this performance by certification, labeling, and inclusion in lists.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

C. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025.

D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.5 WARRANTY

A. Special Assembly Warranty: Manufacturer agrees to repair or replace components of glazed aluminum curtain wall that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration created by wind and thermal and structural movements.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Water penetration through fixed glazing and framing areas.
e. Failure of operating components.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazed aluminum curtain walls.

B. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Glazed aluminum curtain walls shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.

2. Failure also includes the following:

    a. Thermal stresses transferring to building structure.
    b. Glass breakage.
    c. Noise or vibration created by wind and thermal and structural movements.
    d. Loosening or weakening of fasteners, attachments, and other components.
    e. Failure of operating units.

C. Structural Loads:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.

D. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.

    a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:

    a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4-inch for spans greater than 11 feet 8-1/4 inches or 1/175 times span, for spans less than 11 feet 8-1/4 inches.

E. Structural: Test according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:

1. Fixed Framing and Glass Area:

    a. Maximum air leakage of 0.30 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft..

G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..

H. Water Penetration under Dynamic Pressure: Test according to AAMA 501.1 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
2. Maximum Water Leakage: No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.

I. Interstory Drift: Accommodate design displacement of adjacent stories indicated.

1. Design Displacement: As indicated on Drawings.
2. Test Performance: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.4 at design displacement and 1.5 times the design displacement.

J. Seismic Performance: Glazed aluminum curtain walls shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.6 at design displacement and 1.5 times the design displacement.
2. Vertical Interstory Movement: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.7 at design displacement and 1.5 times the design displacement.

K. Energy Performance: Certify and label energy performance according to NFRC as follows:

1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than the value indicated in the 2009 International Code Council's International Energy Conservation Code for curtainwall systems in Climate Zone 5A.
2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.40 as determined according to NFRC 200.
3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 45 as determined according to NFRC 500.

L. Noise Reduction: Test according to ASTM E 90, with ratings determined by ASTM E 1332, as follows:

1. Outdoor-Indoor Transmission Class: Minimum 26.

M. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide 1600 Wall System as manufactured by Kawneer North America, or comparable product by one of the following:
   1. EFCO Corporation.
   2. Oldcastle, Inc.
   3. Shuco USA LP.
   4. TRACO.
   5. Tubelite.
   6. Wausau Window and Wall Systems.
   7. YKK AP America Inc.

B. Source Limitations: Obtain all components of aluminum storefront and framing and curtain wall system, including framing spandrel panels, entrances, and accessories, from single manufacturer.

2.3 FRAMING

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

   1. Construction: Thermally broken.
   2. Glazing System: Retained mechanically with gaskets on four sides.
   3. Glazing Plane: Front.
   4. Finish: Color anodic finish.
   5. Fabrication Method: Either factory- or field-fabricated system.
   6. Aluminum: Alloy and temper r

B. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.

   1. Include snap-on aluminum trim that conceals fasteners.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Materials:

   1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

      a. Sheet and Plate: ASTM B 209.
      b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
      c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
      d. Structural Profiles: ASTM B 308/B 308M.

   2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 ADJUSTABLE PARTITION CLOSURE

A. Manufactured by Gordon Interior Specialties, provide Mullion Mate 5 adjustable partition closure from 5 inches to 6-15/16 inch maximum opening.

B. Finish: Provide custom color to match curtainwall mullion color and finish.

C. Factory spring loaded to fit a variety of openings.

D. Install per manufacturer's written instruction.

E. Locations:
1. Provide in all locations where walls intersect with windows, storefronts, and curtain walls

2.5 INSULATED SPANDREL PANELS

A. Insulated Spandrel Panels: Comply with Division 08 Section "Glazing."

2.6 ENTRANCES

A. Entrances: Comply with Section 08.4110 "Aluminum-Framed Entrances and Storefronts."

2.7 GLAZING

A. Glazing: Comply with Division 08 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

D. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L or less.

E. Sealants used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.8 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.9 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from exterior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Fabricate components to resist water penetration as follows:

1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
2. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.

E. Curtain-Wall Framing: Fabricate components for assembly using manufacturer's standard assembly method.

F. Factory-Assembled Frame Units:

1. Rigidly secure nonmovement joints.
2. Prepare surfaces that are in contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion.
3. Preparation includes, but is not limited to, cleaning and priming surfaces.
4. Seal joints watertight unless otherwise indicated.
5. Install glazing to comply with requirements in Section 088000 "Glazing."

G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.10 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm (0.7 mil) or thicker.

1. Color: Dark Bronze or Black as selected by the Architect.
2. Color Range: Submit manufacturer's color-range samples indicating anticipated variation in the selected finish for Architect's approval.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Where welding is required, weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.

7. Seal joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum is in contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

D. Install components plumb and true in alignment with established lines and grades.

E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

F. Install glazing as specified in Section 088000 "Glazing."

G. Install weatherseal sealant according to Section 079200 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

3.3 ERECTION TOLERANCES

A. Erection Tolerances: Install glazed aluminum curtain walls to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:

   a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
   b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
   c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

END OF SECTION 08.4413

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Sliding doors.
3. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 01 Section "General Conditions".
2. Division 06 Section “Rough Carpentry”.
3. Division 06 Section “Finish Carpentry”.
4. Division 08 Section “Operations and Maintenance”.
5. Division 08 Section “Hollow Metal Doors and Frames”.
6. Division 08 Section “Flush Wood Doors”.
7. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.
8. Division 26 Section "Electrical”

D. Codes and References: Comply with the version adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.
5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
3. Content: Include the following information:

    a. Type, style, function, size, label, hand, and finish of each door hardware item.
    b. Manufacturer of each item.
    c. Fastenings and other pertinent information.
    d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    e. Explanation of abbreviations, symbols, and codes contained in schedule.
    f. Mounting locations for door hardware.
    g. Door and frame sizes and materials.
    h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

   a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
   b. Complete (risers, point-to-point) access control system block wiring diagrams.
   c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

B. Project Record Documents: Provide record documentation of as-built door hardware sets in digital format (.pdf, .docx, .xlsx, .csv) and as required in Division 01, Project Record Documents.

1.5 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

F. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.

G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.

2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

I. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.6 DELIVERY, STORAGE AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.7 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.8 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship

within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Hardware shall not have any visible manufacturer names on exposed materials, except cylinders, when the door is in a closed position.

2.2 BUTT HINGES

A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

    a. Two Hinges: For doors with heights up to 60 inches.
    b. Three Hinges: For doors with heights 61 to 90 inches.
    c. Four Hinges: For doors with heights 91 to 120 inches.
    d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

    a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
    b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

    a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
    b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:

a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for all out-swinging lockable doors.

5. Manufacturers:

a. Hager Companies (HA) - BB Series, 5-knuckle.
b. Ives (IV) - 5BB Series, 5-knuckle.
c. McKinney (MK) - TA/T4A Series, 5-knuckle.

2.3 CONTINUOUS HINGES

A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:.

a. Hager Companies (HA).
b. Ives (IV).
c. Pemko (PE).

2.4 POWER TRANSFER DEVICES

A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

a. Pemko (PE) - EL-CEPT Series.
b. Securitron (SU) - EL-CEPT Series.

B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are

not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

    a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
    b. McKinney (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

    a. Hager Companies (HA) - Quick Connect.
    b. McKinney (MK) - QC-C Series.

2.5 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
5. Manufacturers:

    a. Ives (IV).
    b. Rockwood (RO).

B. Coordinators: ANSI/BHMA A156.3 door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.

1. Manufacturers:

    a. Ives (IV).
    b. Rockwood (RO).

C. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.

2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Pulls shall be provided with a 10” clearance from the finished floor on the push side to accommodate wheelchair accessibility.
5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets. When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
6. Manufacturers:

    a. Hiawatha, Inc. (HI).
    b. Ives (IV).
    c. Rockwood (RO).

2.6 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.
2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
6. Keyway: Manufacturer’s Standard.

C. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. New System: Key locks to a new key system as directed by the Owner.

D. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)

2. Master Keys (per Master Key Level/Group): Five (5).

E. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

2.7 KEY CONTROL

A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:

a. Lund Equipment (LU).
b. MMF Industries (MM).
c. Telkee (TK).

2.8 MORTISE LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide locksets with functions and features as follows:

a. Heavy duty 12-gauge wrought steel case.
b. Stainless steel 3/4" one-piece anti-friction reversible latchbolt with a one-piece hardened stainless steel 1” projection deadbolt.
c. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.
d. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
e. Meets UL Certification Directory ZHLL.R21744 for products used in windstorm rated assemblies.
f. Status indicators inside, outside, or on both sides of doors as specified; available with wording for “locked/unlocked”, “vacant/occupied” or custom wording options. Indicator to be located above the cylinder with the inside thumb-turn not blocking the visibility of the indicator status.
g. Ten-year limited warranty for mechanical functions.

2. Electromechanical locksets shall have the following functions and features:

a. Universal Molex plug-in connectors that have standardized color-coded wiring and are available in fail safe or fail secure and operate from 12vdc to 24vdc regulated.
b. EcoFlex or equivalent technology that reduces energy consumption up to 92% as certified by GreenCircle.
c. Options to be available for request-to-exit or enter signaling, latchbolt and deadbolt monitoring.
d. Two-year limited warranty on electrified functions.

3. Manufacturers:

a. Corbin Russwin Hardware (RU) - ML2000 Series.
b. dormakaba BEST (BE) - 45H Series.
c. Sargent Manufacturing (SA) - 8200 Series.

2.9 DEADLOCKS AND LATCHES

A. Narrow Case Deadlocks and Deadlatches: ANSI/BHMA 156.13 Series 1000 Grade 1 narrow case deadlocks and deadlatches for swinging or sliding door applications. All functions shall be manufactured in a single sized case formed from 12 gauge minimum, corrosion resistant steel (option for fully stainless steel case and components). Provide minimum 2 7/8" throw laminated stainless steel bolt. Bottom rail deadlocks to have 3/8” diameter bolts.

1. Manufacturers:

a. Adams Rite Manufacturing (AD) - MS1850S / MS1950 Series.
b. Adams Rite Manufacturing (AD) - 4900 Series.

2.10 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.

2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.11 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. Exit devices shall have a five-year warranty.
2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.

    a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
    b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide exit devices with functions and features as follows:

    a. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.
    b. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
    c. No catch points: addition of applied deflectors or other added components are not allowed.
    d. No visible plastic.
    e. Heavy duty end caps with flush and overlapping options made of stainless steel, brass, or bronze with architectural finishes.
    f. Constructed of all stainless steel.
    g. Stainless steel pullman type latch with deadlock feature.
    h. Narrow or wide style exterior trim as specified in the hardware sets.
    i. Center case adjustability on concealed vertical rod exit devices; single operation with hex key individually adjusts top or bottom latches. No retainer screws or clips required to maintain adjustment.
    j. Ten-year limited warranty for mechanical features.

2. Electromechanical exit devices shall have the following functions and features:

    a. Universal Molex plug-in connectors that have standardized color-coded wiring and are field configurable in fail safe or fail secure and operate from 12vdc to 24vdc regulated.
    b. Wire routing for all non-access control electromechanical functions and EcoFlex trim to be contained within the carrier of the device eliminating the need for cavities in doors to be drilled. Include a protective film so that wires don't get damaged if the rail needs to be removed.
    c. EcoFlex or equivalent technology that reduces energy consumption up to 92% as certified by GreenCircle.
    d. Options to be available for request-to-exit or enter signaling, latchbolt and touchbar monitoring.
    e. Field configurable electrified trim to fail-safe or fail-secure that operates from 12-24VDC.

3. Manufacturers:

    a. Corbin Russwin Hardware (RU) - PED4000 / PED5000 Series.
    b. Sargent Manufacturing (SA) - PE80 Series.
    c. Von Duprin (VD) - 35A/98 XP Series.

2.12 SURFACE DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Heavy duty surface mounted door closers shall have a 30-year warranty.

2. Manufacturers:

   a. ASSA ABLOY ACCENTRA (YA) - 4400 Series.
   b. Corbin Russwin Hardware (RU) - DC6000 Series.
   c. Sargent Manufacturing (SA) - 351 Series.

2.13 ARCHITECTURAL TRIM AND ACCESSORIES

A. Door, Frame and Wall Protective Trim: ANSI/BHMA A156.6, protective products as specified in the hardware sets. Door protection plates shall be not more than 2" less than door width on stop side and 1” less door width on the pull side or on stop side of pairs of doors. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide protective trim with functions and features as follows:

   a. Meets ADA requirements for smooth bottom door surfaces.
   b. UL Classified options for use on fire-rated doors up to 3 hours.
   c. Fabricated from stainless steel, brass, bronze, aluminum, or high-impact plastic.

d. Available in a variety of sizes, finishes, and profiles to suit aesthetic and functional requirements.
e. Designed to protect doors, frames, and adjacent walls from damage due to impact, abrasion, or traffic.
f. Fasteners included; adhesive-backed options available for select models.
g. Ten-year limited warranty.

2. Manufacturers:

a. Hiawatha, Inc. (HI).
b. Ives (IV).
c. Rockwood (RO).

2.14 DOOR STOPS AND HOLDERS

A. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

a. Hiawatha, Inc. (HI).
b. Ives (IV).
c. Rockwood (RO).

B. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:

a. Norton Rixson (NO).
b. Rockwood (RO).
c. Sargent Manufacturing (SA).

2.15 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. National Guard Products (NG).
2. Pemko (PE).
3. Reese Enterprises, Inc. (RE).

2.16 ELECTRONIC ACCESSORIES

A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Manufacturers:

a. Alarm Controls (AK) - CP1-1026 Series.
b. Securitron (SU) - DPS Series.

B. Switching Power Supplies: Provide the least number of power supplies at the appropriate amperage level sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.

1. Power supplies shall meet all functions and features as specified herein.

a. UL listed dual voltage 12 or 24 VDC field selectable continuous output.

b. Tolerates brownout or overvoltage input ± 15% of nominal voltage.
c. Thermal shutdown protection with auto restart.
d. Circuit breaker protection against overcurrent and reverse battery faults.
e. Integrated battery charging circuit to prevent overvoltage on locking devices.
f. Available with a single relay fire trigger or individually triggered relayed outputs.
g. Monitoring options as specified.

2. Manufacturers:

a. Securitron (SU) - AQD Series.

C. Intelligent Switching Power Supplies: Provide the least number of power supplies at the appropriate amperage level sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.

1. Power supplies shall meet all functions and features as specified herein.

a. UL listed dual voltage 12 or 24 VDC field selectable continuous output.
b. Dedicated fast charger to prolong battery life with low battery cutoff to protect batteries from deep discharge.
c. Enhanced surge immunity for input/output protection
d. Separate, dedicated battery charging circuit to keep locks cooler.
e. Dual-color LED visual notification to prevent applying incorrect voltages to the power supply.
f. Instant auto-switch to battery on AC loss.
g. Expandable up to 16 outputs in the standard enclosure
h. Integrated fire alarm interface to allow main output shutdown or disconnect on a per output basis when using an R8 output module.
i. Network ready and remotely manage locks and connected devices when using an M8 managed output module on network models.
j. Lifetime replacement, no-fault, no questions asked warranty.

2. Manufacturers:

a. Securitron (SU) - AQL Series.

2.17 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.18 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Push Plates and Door Pulls: When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.

E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Refer to Section 080671, Door Hardware Sets, for hardware sets.

END OF SECTION 08.7100

SECTION 08.8000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Related Sections: Section(s) related to this section include:
1. Section 08.1113 “Hollow Metal Doors and Frames”
2. Section 08.1416 “Flush Wood Doors”
3. Section 08.4113 “Aluminum –Framed Entrances and Storefronts”
4. Section 08.4413 “Glazed Aluminum Curtain Walls

C. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Windows.
2. Doors.
3. Glazed curtain walls.
4. Storefront framing.
5. Glazed entrances.
6. Interior borrowed lites.

1.2 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit.

1.3 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.4 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Glass Samples: For each type of glass product; 12 inches square.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

D. Qualification Data: For installers.

E. Product Certificates: For glass and glazing products, from manufacturer.

F. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved by coated-glass manufacturer.

B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

C. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.

D. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

E. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

F. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

G. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings,

whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F, and the fire-resistance rating in minutes.

H. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.

1.8 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: Five years from date of Substantial Completion.

C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified

warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.

B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
2. For laminated-glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

A. Provide heat-strengthened glass at locations where recommended by the glass manufacturer.

B. Provide safety glass as specified in locations where required by Consumer Product Safety Commission "Safety Standard for Architectural Glazing Material" (16 CFR 1201.)

C. GLASS MANUFACTURERS:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Guardian Glass, LLC; or comparable product by one of the following:

a. Vitro.
b. Pilkington North America.

D. GLASS TYPES
1. Low Iron Tempered Glass: Indicated on Drawings as "**CT**"
a. 1/4 inch (6 mm), UltraClear (low Iron) glass by Guardian Glass, LLC; or equal products of alternatives of the quality necessary to meet the specifications.
b. Heat Treatment: Tempered.
c. Provide where safety glazing is required by CPSC 16 CFR 1201 and indicated on drawings.

2. Low Iron, Low-E Coated, Insulating **Vision** Glass: Indicated on Drawings as "**CIG**"
a. Overall Unit Thickness: 1 inch (25 mm).
b. Minimum Thickness of Each Glass Lite: 1/4 inch (6 mm).
c. Outboard Lite: Guardian UltraClear Low Iron Float Glass.
1) Low-E Coating Sputtered on Surface #2: Guardian SunGuard SN 68 or comparable product.
2) Heat Treatment: Heat Strengthened.
d. Interspace: Argon filled, 12 mm (1/2 inch) wide, hermetically sealed.
e. Inboard Lite: Guardian UltraClear Low Iron float glass.
1) Heat Treatment: Heat Strengthened.
f. Glass Unit Performance Characteristics:
1) Visible Light Transmittance: 71 percent minimum.
2) Solar Heat Gain Coefficient: 0.39 maximum.
3) Winter Nighttime U-Factor: 0.245 maximum.
4) Summer Daytime U-Factor: 0.22 maximum.

3. Low Iron, Low-E Coated, Fully Tempered, Insulating **Vision** Glass: Indicated on Drawings as "**CIT**"
a. Overall Unit Thickness: 1 inch (25 mm).
b. Minimum Thickness of Each Glass Lite: 1/4 inch (6 mm).
c. Outboard Lite: Guardian UltraClear Low Iron Float Glass.
1) Low-E Coating Sputtered on Surface #2: Guardian SunGuard SN 68 or comparable product.
2) Heat Treatment: Fully tempered.
d. Interspace: Argon filled, 12 mm (1/2 inch) wide, hermetically sealed.
e. Inboard Lite: Guardian UltraClear Low Iron float glass.
1) Heat Treatment: Fully tempered.
f. Glass Unit Performance Characteristics:
1) Visible Light Transmittance: 68.1 percent minimum.
2) Solar Heat Gain Coefficient: 0.37 maximum.
3) Winter Nighttime U-Factor: 0.245 maximum.
4) Summer Daytime U-Factor: 0.22 maximum.
g. Provide in Curtainwall, Storefront System and Sliding Aluminum-Framed Glass Doors and where safety glass is required by CPSC 16 CFR 1201.

4. Ceramic or Silicone Coated, Low Iron, Low-E Coated, Insulating **Spandrel** Glass: Indicated on Drawings as "**SP-01**"

a. Overall Unit Thickness: 1 inch (25 mm).
b. Minimum Thickness of Each Glass Lite: 1/4 inch (6 mm).
c. Outboard Lite: Guardian UltraClear Float Glass.
    1) Low-E Coating Sputtered on Surface #2: Guardian SunGuard SN 68 or comparable product.
    2) Heat Treatment: Fully tempered.
d. Interspace: Argon filled, 12 mm (1/2 inch) wide, hermetically sealed.
e. Inboard Lite: Guardian UltraClear float glass.
    1) Spandrel Coating on Surface #4: Harmonizing Color Wind Breaker (LI), Spandrel Number 3-4913LI, "OPACI-COAT-300®" by ICD Coatings or alternatives of the quality necessary to meet the specifications.
    2) Heat Treatment: Fully tempered.
f. Glass Unit Performance Characteristics:
    1) Visible Light Transmittance: 0 percent minimum.
    2) Solar Heat Gain Coefficient: 0.29 maximum.
    3) Winter Nighttime U-Factor: 0.245 maximum.
    4) Summer Daytime U-Factor: 0.22 maximum.

5. Fire-Protection Rated Glazing: Indicated on Drawings as "**FRG**"
    a. Location: Interior.
    b. Laminated Glazing: Clear, Low-iron flat glass: 1-3/8 inch nominal thickness
    c. Visible Transmission: 88%
    d. STC rating: Minimum 39
    e. Rating: 60 minutes w/ hose stream. ASTM E119 & UL 263
    f. Impact Safety Rating: CPSC 16 CFR 1201 Cat. I and II & ANSI Z97.1
    g. Hard Body Impact Classification: ASTM C1629/C1629M Level 3
    h. Soft Body Impact Classification: ASTM E695 Level 3
    i. Surface Abrasion Resistance: ASTM D4977 Level 3
    j. Subject to compliance provide glass by:
        1) Safti First: **SuperLite II-XL 60** (Basis of Design)
        2) FireLite
        3) Schott North America, Inc.; Pyran Star
        4) Vetrotech Saint-Gobain: SGG Keralite FR-R
        5) Pilkington: Pyrostop

2.3 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:

1. Neoprene complying with ASTM C 864.
2. EPDM complying with ASTM C 864.
3. Silicone complying with ASTM C 1115.
4. Thermoplastic polyolefin rubber complying with ASTM C 1115.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene, EPDM, silicone, or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.

C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

D. Neoprene Glazing Gaskets for bullet resistant glazing:
1. Interior Glazing gaskets closed cell cellular neoprene conforming to ASTM C509 Type II Option 1 with a 40-50 Shore A Durometer.
2. Exterior Glazing gaskets solid neoprene conforming to ASTM C864 with a 65-75 Shore A Durometer.

2.4 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Dow Corning Corporation; 790.
   b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
   c. Tremco Incorporated; Spectrem 1.

C. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.

D. Glazing Sealants for bullet resistant glazing:
1. Dow 995 or Dow 795 for exterior applications.
2. Dow 995, Dow 795, or 3M IPA for interior applications.

2.5 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.6 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

G. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.7 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing

tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Fabricate compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 APPLIED GLAZING FILM

A. Apply glazing film at locations indicated, according to manufacturer’s written instructions.

3.8 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 08.8000

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silvered flat glass mirrors.

B. Related Requirements:

1. Section 08.8000 "Glazing" for glass with reflective coatings used for vision and spandrel lites.
2. Section 10.2800 "Toilet, Bath, and Laundry Accessories" for metal-framed mirrors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Mirrors: Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.

B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachment details.

C. Samples: For each type of the following:

1. Mirrors: 12 inches (300 mm) square, including edge treatment on two adjoining edges.
2. Mirror Clips: Full size.
3. Mirror Trim: 12 inches (300 mm) long.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of mirror and mirror mastic.

C. Preconstruction Test Reports: From mirror manufacturer indicating that mirror mastic was tested for compatibility and adhesion with mirror backing and substrates on which mirrors are installed.

D. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For mirrors to include in maintenance manuals.

1.5 PRECONSTRUCTION TESTING

A. Preconstruction Mirror Mastic Compatibility Test: Submit mirror mastic products to mirror manufacturer for testing to determine compatibility of mastic with mirror backing.

1. Testing is not required if data are submitted based on previous testing of mirror mastic products and mirror backing matching those submitted.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect mirrors in accordance with mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Guardian UltraMirror by Guardian Glass, LLC, fabricated as specified.
   1. Alternative products subject to Division 01 requirements for Substitutions.

B. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.

C. Source Limitations for Mirror Accessories: Obtain mirror-glazing accessories from single source.

D. Tempered Glass Mirrors: Mirror Glazing Quality for blemish requirements and complying with ASTM C1048 for Kind FT, Condition A, tempered float glass before silver coating is applied; clear.

   1. Nominal Thickness: ¼" (6.0 mm).

   2. Comply with ASTM C1503 for silvered flat-glass mirrors.

E. Safety Glazing Products: For tempered mirrors, provide products that comply with 16 CFR 1201, Category II and ANSI Z97.1, Class A.

2.2 MISCELLANEOUS MATERIALS

A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

D. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

2.3 MIRROR HARDWARE

A. Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover edges of mirrors in a single piece.

1. Aluminum J Channel Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch (9.5 and 22 mm) in height, respectively, and a thickness of not less than 0.04 inch (1.0 mm).

2. Aluminum J Channel Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch (16 and 25 mm) in height, respectively, and a thickness of not less than 0.04 inch (1.0 mm).

3. Finish: Clear anodized.

B. Mirror Bottom Clips: As indicated.

C. Mirror Top Clips: As indicated.

D. Plated Steel Hardware: Formed-steel shapes with plated finish indicated.

1. Profile: As indicated.
2. Finish: Polished Chrome.

E. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

F. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield, expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

2.4 FABRICATION

A. Shop fabricate mirrors to greatest extent possible.

B. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts, so they fit closely around penetrations in mirrors.

C. Mirror Edge Treatment: Flat high polished.

1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.

2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

D. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint, as recommended in writing by film-backing manufacturer, to produce a surface free of bubbles, blisters, and other imperfections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.

B. Verify compatibility with and suitability of substrates, including compatibility of existing finishes or primers with mirror mastic.

C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced National Glass Association (NGA) publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.

1. NGA Publications: “Glazing Manual" and "Installation Techniques Designed to Prolong the Life of Flat Glass Mirrors."

B. Provide a minimum airspace of 1/8 inch (3 mm) between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

C. Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.

1. Aluminum J-Channels: Provide setting blocks 1/8 inch (3 mm) thick by 4 inches (100 mm) long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4 inch (6.4 mm) wide by 3/8 inch (9.5 mm) long at bottom channel.
2. Aluminum J-Channels and Cleat: Fasten J-channel directly to wall and attach top trim to continuous cleat fastened directly to wall.
3. Mirror Clips: Place a felt or plastic pad between mirror and each clip to prevent spalling of mirror edges. Locate clips so they are symmetrically placed and evenly spaced.
4. Install mastic as follows:

    a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
    b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
    c. After mastic is applied, align mirrors and press into place while maintaining a minimum airspace of 1/8 inch (3 mm) between back of mirrors and mounting surface.

3.4 CLEANING AND PROTECTION

A. Protect mirrors from breakage and contaminating substances resulting from construction operations.

B. Do not permit edges of mirrors to be exposed to standing water.

C. Maintain environmental conditions that prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

D. Clean exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Clean mirrors as recommended in writing by mirror manufacturer and NGA's publication "Proper Procedures for Cleaning Flat Glass Mirrors."

END OF SECTION 08.8300

SECTION 08.9000 - ARCHITECTURAL LOUVERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Extruded aluminum inverted chevron stationary louver with drainable blades.

B. Blank-off panels for louvers

1.2 RELATED SECTIONS

A. Section 03 30 00 - Cast-In-Place Concrete.

B. Section 04 20 00 - Masonry Units.

C. Section 05 12 00 - Structural Steel Framing.

D. Section 06 10 53 – Miscellaneous Rough Carpentry.

E. Section 07 42 00 – Architectural Metal Wall Panels.

F. Section 07 62 00 – Sheet Flashing and Trim.

G. Section 07 92 00 - Joint Sealants.

H. Section 09 22 16 – Non-Structural Metal Framing

I. Section 09 91 00 - Painting.

J. Section 23 00 00 - Heating, Ventilation, and Air Conditioning

1.3 REFERENCES

A. AAMA 2604 – High Performance Organic Coatings on Architectural Extrusions and Panels.

B. AAMA 2605 - High Performance Organic Coatings on Architectural Extrusions and Panels.

C. AAMA 611 – Voluntary Specification for Anodized Architectural Aluminum.

D. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.

E. AMCA 511 - Certified Ratings Program for Air Control Devices..

F. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

G. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

I. ASTM D822 - Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings

J. ASTM D2244 - Standard Test Method for Calculation of Color Differences From Instrumentally Measured Color Coordinates.

K. ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.

1.4 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.

C. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

D. Rain-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

1. Show weep paths, gaskets, flashings, sealants, and other means of preventing water intrusion.
2. Show mullion profiles and locations.

C. Delegated-Design Submittal: For louvers indicated to comply with structural and seismic performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Product Test Reports: For each type of louver, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For manufacturer's warranties.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. The manufacturer shall have implemented the management of quality objectives, continual improvement, and monitoring of customer satisfaction to assure that customer needs and expectations are met.
   2. Manufacturer shall be International Organization for Standardization (ISO) 9001 accredited.

B. Product Qualifications:
   1. Louvers licensed to bear AMCA Certified Ratings Seal. Ratings based on tests and procedures performed in accordance with AMCA 511 and comply with AMCA Certified Ratings Program. AMCA Certified Ratings Seal applies to air performance and water penetration ratings.

   2. Louvers shall be factory engineered to withstand the specified seismic loads.
      a. Minimum design loads shall be calculated to comply with ASCE – 7, or local requirements of Authority Having Jurisdiction (AHJ).

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store materials in a dry area indoors, protected from damage and in accordance with manufacturer's instructions.

C. Handling: Protect materials and finishes during handling and installation to prevent damage.

D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.9 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.10 WARRANTY

A. Manufacturer shall provide standard limited warranty for louver systems for a period of five years (60 months) from date of installation, no more than 60 months after shipment from manufacturing plant. When notified in writing from the Owner of a manufacturing defect, manufacturer shall promptly correct deficiencies without cost to the Owner.

B. Manufacturer shall provide 20-year limited warranty for fluoropolymer-based finish on extruded aluminum substrates.
Finish coating shall not peel, blister, chip, crack or check.
Chalking, fading or erosion of finish when measured by the following tests:
   a. Finish coating shall not chalk in excess of 8 numerical ratings when measured in accordance with ASTM D4214.
   b. Finish coating shall not change color or fade in excess of 5 NBS units as determined by ASTM D2244 and ASTM D822.
   c. Finish coating shall not erode at a rate in excess of 10%/ 5 year as determined by Florida test sample.

C. Manufacturer shall provide a 5-year limited warranty for Class I and a 3-year limited warranty for Class II anodized finish on extruded aluminum substrates.
   1. Seller warrants the Finish under normal atmospheric conditions.
      a. Will not crack, craze, flake or blister
      b. Will not change or fade more than (5) Delta-E Hunter units as determined by ASTM method D-2244
      c. Will not chalk in excess of ASTM D-4214-07 number (8) rating, determined by the procedure outlined in ASTMD-4214-07 specification test.
   2. Any forming or welding must be done prior to finishing. Post forming or welding will void the warranty.
   3. This Warranty applies only if the anodized aluminum product is installed in strict accordance with Seller's recommended practices and maintained in accordance with AAMA (American Architectural Manufacturers Association) publication number 609 and 610-09 ("Cleaning and Maintenance Guide for Architecturally Finished Aluminum").

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers standard drainable sight proof louvers, as manufactured by; Ruskin or alternatives of the quality necessary to meet the specifications.

B. Available Manufacturers: Subject to compliance with requirements, provide the named product or comparable product by one of the following:
   1. Airolite Company, LLC (The).
   2. Greenheck Fan Corporation.
   3. Pottorff.
   4. Ruskin Company.

C. Manufacturers of equivalent products submitted and approved in accordance with Section 01630 – Product Substitution Procedures.

2.2 STATIONARY BLADE LOUVER

A. Fabrication:

1. Design: Stationary inverted chevron blade louver with mechanical fastened construction. Hidden vertical supports to allow limited continuous line appearance.
2. Frame:
   a. Frame Depth: 4 inches as indicated on drawings.
   b. Frame Depth: 6 inches as indicated on drawings
   c. Wall Thickness: 0.081 inch (2.1 mm), nominal.
   d. Material: Extruded aluminum, Alloy 6063-T6.
3. Blades:
   a. Style: Inverted Chevron 45 degrees spaced at 1 7/16 inches (36.5 mm)
   b. Wall Thickness: 0.081 inch (2.1 mm), nominal.
   c. Material: Extruded aluminum, Alloy 6063-T6.
4. Minimum Assembly Size: 12 inches wide by 12 inches high (305 mm x 305 mm).
5. Maximum Factory Assembly Size: Single sections shall not exceed 72 inches wide by 144 inches high (1829 mm x 3658 mm) . Louvers larger than the maximum single size shall be constructed of smaller sections.

B. Performance Data:
1. Performance Ratings: AMCA licensed.
   a. Based on testing 48 inch by 48 inch (1219 mm by 1219 mm) size unit in accordance with AMCA 500.
2. Free Area: 45 percent, nominal.
3. Free Area Size: 7.29 sf (.68 sm).
4. Maximum Recommended Air Flow through Free Area: 2024 feet per minute (7.2 m/s).
5. Air Flow: 14755 cubic feet per minute (418 cu. m/min).
6. Maximum Pressure Drop: .42 inches w.g. (.05 kPa).

C. Wind Driven Water Penetration Performance:
1. Based on testing 39 inches x 39 inches (1 m x 1 m) core area, 41 inches x 44 inches (1.04 m x 1.12 m) nominal size unit in accordance with AMCA 500-L.
2. Wind Velocity: 29 mph (47 kph).
   a. Rainfall Rate: 3 inches/hour (76 mm/hour).
   b. Free Area Velocity: 2010 feet per minute (10.0 m/sec).
   c. Water Resistance Effectiveness: 100% (AMCA Class A).
3. Wind Velocity: 50 mph (80 kph).
   a. Rainfall Rate: 8 inches/hour (203 mm/hour).
   b. Free Area Velocity: 2024 feet per minute (10.1 m/sec).
   c. Water Resistance Effectiveness: 100% (AMCA Class A).

A. Design Windload: Per Code.

B. Design Windload: Incorporate structural supports required to withstand wind load of _20 pounds per square foot.

C. Louvers shall be factory engineered to withstand the specified seismic loads.
1. Minimum design loads shall be calculated to comply with ASCE – 7, or local requirements of Authority Having Jurisdiction (AHJ).

2.3 ACCESSORIES

A. Insulated Blank-Off Panels: Laminated panels consisting of an insulating core surfaced on back and front with metal sheets and attached to back of louver.
   1. Thickness: 2 inches .
   2. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch nominal thickness.
   3. Insulating Core: Rigid, glass-fiber-board insulation or extruded-polystyrene foam .
   4. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard extruded-aluminum-channel frames, not less than 0.080-inch nominal thickness, with corners mitered and with same finish as panels.
   5. Seal perimeter joints between panel faces and louver frames with gaskets or sealant.
   6. Panel Finish: Same finish applied to louvers .
   7. Attach blank-off panels with sheet metal screws .
   8. Provide at locations open to mechanical rooms

B. Bird Screen:
   1. Aluminum: Aluminum, 1/2 inches by 0.063 inch (13 mm by 1.6 mm), expanded and flattened.
   2. Frame: Removable.

C. Insect Screens:
   1. Aluminum: 18-16 mesh, mill finish, .011 inch (0.3 mm) wire.
   2. Frame: Aluminum.

D. Extended Sills:
   1. Extruded aluminum, Alloy 6063-T6. Minimum nominal thickness 0.060 inch (1.5 mm).

E. Visible Mullions: Manufacturer's standard horizontal or vertical visible mullions for architectural accent as indicated on drawings.

2.4 FINISHES

A. Finish: 50 percent PVDF: Finish shall be applied at 1.2 mil total dry film thickness.
   1. Coating shall conform to AAMA 2604, sections 4.2 and 4.3. Apply coating following cleaning and pretreatment. Cleaning: AA-C12C42R1X.
      a. Baked Enamel (50% PVDF).
      b. Pearledize 50 (2-coat mica).
   2. 20-year finish warranty.

B. Finish: Prime Coat:
   1. Apply alkyd prime coat following chemical cleaning and pretreatment.
   2. Primer preparation for field painting.

C. Color: Custom color to match metal panels.

PART 3 EXECUTION

3.1 EXAMINATION

A. Inspect areas to receive louvers. Notify the Architect of conditions that would adversely affect the installation or subsequent utilization of the louvers. Do not proceed with installation until unsatisfactory conditions are corrected.

B. If opening preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean opening thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install louvers at locations indicated on the drawings and in accordance with manufacturer's instructions.

B. Install louvers plumb, level, in plane of wall, and in alignment with adjacent work.

C. The supporting structure shall be designed to accommodate the point loads transferred by the louvers when subject to the design wind loads.

D. Install joint sealants as specified in Section 07 92 00.

3.4 CLEANING

A. Clean louver surfaces in accordance with manufacturer's instructions.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 08.9000

SECTION 09.2216 – NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes non-load-bearing steel framing members for the following applications:

1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
2. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

B. Related Sections

1. Division 09 “Gypsum Board”
2. Division 06 “Sheathing”

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

PART 2 - PRODUCTS

2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
2. Protective Coating: ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized, unless otherwise indicated.

2.2 STEEL FRAMING FOR FRAMED ASSEMBLIES

A. Steel Studs and Runners: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.0179 inch (0.45 mm) unless indicated otherwise.
2. Minimum Base-Metal Thickness: 0.0312 inch (0.79 mm) wherever gypsum board or cementitious backer boards (CBB) are scheduled and at low-height partitions.
3. Depth: 3-5/8 inches (92.1 mm) unless indicated otherwise on Drawings.

B. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- (50.8-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
2. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

a. Products: Subject to compliance with requirements, provide one of the following:

1) Steel Network Inc. (The); VertiClip SLD Series.
2) Superior Metal Trim; Superior Flex Track System (SFT).

C. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: 0.0312 inch (0.79 mm).

D. Cold-Rolled Channel Bridging: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges.

1. Depth: 1-1/2 inches (38.1 mm).
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38.1 by 38.1 mm), 0.068-inch- (1.73-mm-) thick, galvanized steel.

E. RC Resilient Channel: RC Deluxe Resilient Channel by Clark Dietrich, or equal.
1. 22 mil steel, Grade 33ksi minimum yield strength
2. Coating: G40EQ
3. Meet or exceed ASTM C645 and ASTM A 1003.
4. Dimensions: 2-5/8 inches by 1/2-inch.

F. Sound Isolation Clips: Basis of Design IsoMax as manufactured by Kinetics Noise Control.
1. Provide furring channel widths from 2.38 inches to 2.75 inches.
2. Dimensions: 1-inch wide by 3.86-inches wide.
3. Location: Provide in mechanical rooms B-119, B133, B-211, B225, B-311, B-325 on wall separating mechanical room and classroom and as indicated on Drawings.

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.

1. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
2. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

B. Install studs so flanges within framing system point in same direction.

1. Space studs as follows:

a. Single-Layer Application: 16 inches (406 mm) o.c., unless otherwise indicated.
b. Multilayer Application: 16 inches (406 mm) o.c., unless otherwise indicated.
c. Tile backing panels: 16 inches (406 mm) o.c., unless otherwise indicated.

C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

a. Install two studs at each jamb, unless otherwise indicated.
b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (12.7-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions:

    a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
    b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches (150 mm) o.c.

D. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

END OF SECTION 09.2216

SECTION 09.2900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Standard Gypsum Board
2. Abused Resistant Gypsum Board
3. Fire-Resistance Rated Gypsum Board
4. Mold and Moisture Resistant Gypsum Board
5. Cement Board
6. Ceiling Board.

B. Related Requirements:

1. Division 06 "Sheathing" for gypsum sheathing for exterior walls.
2. Division 07 "Thermal Insulation" for building insulation.
3. Division 09 "Gypsum Board Shaft Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.
4. Division 09 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.
5. Division 09 "Ceramic Tiling" for cementitious backer units installed as substrates for ceramic tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show locations, fabrication, and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other units of Work.

C. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance-Rated Assemblies: Indicated by design designations from UL's "Fire Resistance Directory."

B. Sound Transmission Characteristics: For gypsum board assemblies with STC ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.

1. STC-Rated Assemblies: Indicated by design designations from GA-600, "Fire Resistance Design Manual."

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Gypsum Board and Related Products:
      a. National Gypsum Company.
      b. Certainteed Corp.
      c. G-P Gypsum Corp.
      d. United States Gypsum Co.

2.3 STANDARD GYPSUM BOARD

A. Gypsum Wallboard: ASTM C1396/C1396M.

B. Basis of Design: Gold Bond® BRAND Gypsum Board
   1. Panel Physical Characteristics:
      a. Core: Regular gypsum core.
      b. Surface Paper: 100 percent recycled content paper on front, back and long edges.
      c. Long Edges: Tapered.
      d. Overall Thickness: 5/8 inch (15.9 mm).
      e. Panel complies with requirements of ASTM C 1396
   2. Location: Typical wall construction (unless noted otherwise). See drawings

2.4 FIRE-RESISTANCE RATED GYPSUM BOARD

A. Gypsum Board, Type X: ASTM C1396/C1396M.

B. Basis of Design: Gold Bond® BRAND Fire-Shield C™ Gypsum Board
   1. Type C, Panel Physical Characteristics
      a. Core: Enhanced fire-resistance rated (Type C) gypsum core

b. Surface paper: 100 percent recycled content paper on front, back and long edges
c. Long Edges: Tapered
d. Overall thickness: 5/8 inch (15.9 mm).
e. Panel complies with Type X requirements of ASTM C 1396.

2. Location: All fire-rated walls. See drawings

2.5 ABUSE RESISTANT GYPSUM BOARD

A. ASTM C1396/C1396M gypsum board, tested according to ASTM C1629/C1629M.
B. Basis of Design: Gold Bond BRAND Hi-Abuse® XP® Gypsum Board
C. Performance Criteria - Wall Assembly STC: 52

1. Panel Physical Characteristics:
   a. Core: Fire-resistance rated gypsum core, with additives to enhance surface indentation resistance and impact resistance.
   b. Surface paper: Abrasion resistant, 100 percent recycled content moisture/mold/mildew resistant paper on front, back and long edges.
   c. Overall thickness: 5/8 inch (15.9 mm).
   d. Long Edges: Tapered.
   e. Panel complies with Type X requirements of ASTM C 1396.
   f. Surface Abrasion Resistance: ASTM C1629/C1629M, meets or exceeds Level 3 requirements.
   g. Indentation Resistance: Classification Level 1 in accordance with ASTM C 1629.
   h. Soft Body Impact Resistance: Classification Level 2 in accordance with ASTM C 1629.
   i. Hard Body Impact Resistance: Classification Level 1 in accordance with ASTM C 1629.
   j. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2. Location: All corridors and vestibules. See drawings.

2.6 MOLD-RESISTANT GYPSUM BOARD

A. ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.
B. Basis of Design: Gold Bond® BRAND XP Gypsum Board

1. Panel Physical Characteristics:
   a. Core: Mold and moisture resistant gypsum core
   b. Surface paper: 100 percent recycled content moisture/mold/mildew resistant paper on front, back, and long edges
   c. Long Edges: Tapered
   d. Overall thickness: 5/8 inch
   e. Panel complies with requirements of ASTM C 1396

f. Mold/Mildew Resistance: 10 when tested in accordance with ASTM D 3273

2. Location: All restroom, shower, locker room locations. See drawings.

2.7 CEMENT BOARD

A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.
B. Cement Backerboard Basis of Design: PermaBase® BRAND Cement Board.

1. Panel Physical Characteristics:
   a. Core: Cementitious, water-durable
   b. Surface: Fiberglass mesh on front and back
   c. Long Edges: Round
   d. Overall Thickness: 5/8 inch
   e. Panel complies with requirements of ASTM C 1325 and ANSI A 118.9
   f. Density: 72 lbs. per cu. ft.
   g. Water Absorption: Not greater than 8 percent when tested for 24 hours in accordance with ASTM C 473
   h. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.
   i. Mold/Mildew Resistance: ASTM G21; Score of 0.
   j. Shear Bond Strength: > 50 psi.

2. Location: Partition types with tile. See drawings.

2.8 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:

   a. Cornerbead.
   b. Bullnose bead.
   c. LC-Bead: J-shaped; exposed long flange receives joint compound.
   d. L-Bead: L-shaped; exposed long flange receives joint compound.
   e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
   f. Expansion (control) joint.
   g. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Exterior Trim: ASTM C1047.

1. Material: Hot-dip galvanized-steel sheet.

2. Shapes:

    a. Cornerbead.
    b. LC-Bead: J-shaped; exposed long flange receives joint compound.

2.9 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

C. Acoustical sealant:
1. Conform to ASTM C 919
2. VOC content less than 2 g/L
3. Products/Manufacturer:
    a. Grabber Acoustical Sealant GSC
    b. STI SpecSeal Smoke N Sound Caulk
    c. BOSS 824 Acoustical Sound Sealant.

D. Firestopping:
1. Conform to ASTM E 90
2. Products/Manufacturer:
    a. STI SpecSeal SSP Putty Pads
    b. BOSS 818 Fire Rated Putty Pads.

E. Fasteners for use with cement board
1. PermaBase Cement Board drill point screws (No. 8)
    a. Wafer head, corrosion-resistant
    b. Overall Thickness: 1-5/8 inch
    c. For use with 20 to 14 ga. Steel framing and complying with ASTM C 1002

F. Joint Treatment
1. Tape:
    a. Paper Tape: 2-1/16 inches wide
    b. Paper Tape: 2 inches wide with metal strips laminated along the center crease to form inside and outside corners
    c. Fiberglass Tape: Nominal 2 inches wide self-adhering tape

G. Joint Sealant
   1. Conform to ASTM C 920
   2. VOC content less than 2 g/L

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Ceilings: Coordinate installation of ceiling suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers at spacing required to support ceilings and that hangers will develop their full strength.

   1. Furnish concrete inserts and other devises indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:

   1. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of gypsum board assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

3.3 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216.

B. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

C. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

D. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

E. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

F. Attach gypsum panels to framing provided at openings and cutouts.

G. Form control and expansion joints with space between edges of adjoining gypsum panels.

H. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

I. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

K. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.

1. Space screws a maximum of 12 inches (304.8 mm) o.c. for vertical applications.

L. Space fasteners in panels that are tile substrates a maximum of 8 inches (203.2 mm) o.c.

3.4 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
   1. Regular Type: Vertical surfaces, unless otherwise indicated.
   2. Type X: Where required for fire-resistance-rated assembly.
   3. Flexible Type: Apply in double layer at curved assemblies.
   4. Ceiling Type: Ceiling surfaces.

3.5 PANEL APPLICATION METHODS

A. Single-Layer Application:

   1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
   2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

      a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
      b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.

   3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
   4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

B. Multilayer Application:

   1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
   2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
   3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.

4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.
5. For double-layer construction, fasten base layer to studs with screws 16 inches (400 mm) o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches (300 mm) o.c.

3.6 INSTALLATION OF TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.7 INSTALLATION OF TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. Bullnose Bead: Use where indicated.
3. L-Bead: Use where indicated.
4. U-Bead: Use at exposed panel edges.

3.8 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
   a. Where level 1 gypsum board finish is indicated, apply joint compound specified for embedding coat.
2. Level 4: For all exposed gypsum board surfaces.

   a. For level 4 gypsum board finish, embed tape in finishing compound plus two separate coats applied over joints, angles, fastener heads, and trim accessories.

   b. Primer and its application to surfaces are specified in Section 09.9100 "Painting."

E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.9 FIELD QUALITY CONTROL

A. Above-Ceiling Observation: Architect will conduct an above-ceiling observation before installing gypsum board ceilings and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.
   1. Notify Architect seven days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation
   2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:
      a. Installation of 80 percent of lighting fixtures, powered for operation.
      b. Installation, insulation, and leak and pressure testing of water piping systems.
      c. Installation of air-duct systems.
      d. Installation of air devices.
      e. Installation of mechanical system control-air tubing.
      f. Installation of ceiling support framing.

3.10 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09.2900

SECTION 09.3000 – TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Porcelain tile
2. Marble thresholds
3. Tile backing panels
4. Waterproof membrane.
5. Cleavage membrane.
6. Crack isolation membrane.
7. Metal edge strips.

B. Related Sections:

1. Division 07 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

2. Division 09 Section "Gypsum Board" for cementitious backer units and glass-mat, water-resistant backer board.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. Face Size: Actual tile size, excluding spacer lugs.

C. Module Size: Actual tile size plus joint width indicated.

1.4 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:

1.5 SUBMITTALS

A. Product Data: For each type of product

B. Samples:

1. Each type and composition of tile and for each color and finish required. [For porcelain tile in color blend patterns, provide samples of each color blend.]

2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required.

3. Marble thresholds

1.6 QUALITY ASSURANCE

A. Tile Council of America, Inc., "Handbook for Ceramic Tile Installation," latest edition.

B. American National Standards Institute (ANSI) "American National Standard Specifications for Ceramic Tile - ANSI-137.1."

C. Source Limitations for Tile: Obtain tile of each type and color or finish from one source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

D. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.

E. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:

1. Marble thresholds.
2. Waterproof membrane.
3. Crack isolation membrane.
4. Joint sealants.
5. Cementitious backer units.
6. Metal edge strips.

F. Pre-installation Conference: Conduct conference at Project site.

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained, and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Tile and Trim Units: Furnish quantity of full-size units equal to 5 percent of amount installed for each type, composition, color, pattern, and size indicated but no less than one carton of each type and color. Box for storage, date, and mark the box "maintenance tile".

C. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

E. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by pre-coating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.2 TILE PRODUCTS

A. Basis of design manufacture: Daltile Corporation and Tilebar as indicated on the Design Selection Schedule.

B. Accepted alternate manufactures include Crossville, Interceramic, and American Olean.

C. Floor Tile: Indicated on the Drawings as PFT-01, 02.

D. Wall Tile: Indicated on Drawings as CWT-01, 02.

E. Wall Base: SCHLUTER DILEX-AHK. See details within Construction Drawings.

2.3 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.

B. Marble Thresholds: ASTM C 503, with a minimum abrasion resistance of 10 per ASTM C 1353 or ASTM C 241 and with honed finish.

1. Description: Provide the following or approved equal:
   a. Vermont Marble Company "Imperial Danby".

2.4 WATERPROOF MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 40 mil nominal thickness.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Noble Company (The); Nobleseal “Chloraloy 240”

2.5 CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.12 for heavy duty performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 30 mil nominal thickness.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Noble Company (The); Nobleseal CIS.

2.6 CLEAVAGE MEMBRANE

A. Cleavage Membrane: 15-pound roofing felt ASTM D 226, for use under full set tile locations on slab on grade, unless other material is indicated on the Drawings or specified.

2.7 SETTING MATERIALS

A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.

   1. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils (0.1 mm) thick.
   2. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches (50.8 by 50.8 mm) by 0.062-inch (1.57-mm) diameter; comply with ASTM A 185 and ASTM A 82 except for minimum wire size.
   3. Expanded Metal Lath: Diamond-mesh lath complying with ASTM C 847.

      a. Base Metal and Finish for Interior Applications: Uncoated or zinc-coated (galvanized) steel sheet, with uncoated steel sheet painted after fabrication into lath.
      b. Base Metal and Finish for Exterior Applications: Zinc-coated (galvanized) steel sheet.
      c. Configuration over Studs and Furring: Flat.
      d. Configuration over Solid Surfaces: Self furring.
      e. Weight: 2.5 lb/sq. yd.

   4. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.

B. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Bonsal American; an Oldcastle company.
   b. Bostik, Inc.
   c. Laticrete International, Inc.
   d. MAPEI Corporation.

2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
3. Provide prepackaged, dry-mortar mix combined with [liquid-latex additive at Project site.
4. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

2.8 GROUT MATERIALS

A. Polymer-Modified Tile Grout: ANSI A118.7.

1. Basis-of-Design Product: Subject to compliance with requirements, provide “Classic Collection” and “Designer Series” as manufactured by MAPEI Corporation or comparable product by one of the following:
   a. Bonsal American; an Oldcastle company.
   b. Laticrete International, Inc.
   c. Southern Grouts & Mortars, Inc.
   d. Summitville Tiles, Inc.
2. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.

2.9 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 07 Section "Joint Sealants."

1. Use sealants that have a VOC content of [250] <Insert limit> g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.

C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.

1. Products: Subject to compliance with requirements, provide the following or approved equal:
   a. Dow Corning Corporation; Dow Corning 786TR-WHT.

2.10 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Divider Strip: Types as indicated on Drawings as manufactured by Schluter Systems L.P., Plattsburgh, NY; or alternatives of the quality necessary to meet the specifications.

C. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.

1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F per ASTM D 87.
2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.11 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors comply with surface finish requirements in ANSI A108.01 for installations indicated.

a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not, factory blended, either return to manufacturer or blend tiles at Project site before installing.

D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 TILE INSTALLATION

A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments. Use bullnosed shapes to terminate tile except at inside corners.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Align joints where adjoining tiles on floor, base, walls, and trim are the same size.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

E. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Ceramic Mosaic Tile: 1/16 inch.
2. Quarry Tile: 1/4 inch.
3. Paver Tile: 1/4 inch.
4. Glazed Wall Tile: 1/16 inch.
5. Decorative Thin Wall Tile: 1/16 inch.

F. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated on Drawings and as follows. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where tile floors abut vertical surfaces such as bases, walls, curbs, etc., provide 1/4-inch-wide control joints, full depth through the ceramic tile and under bed, to receive control joint sealant.
2. At building control points, between ceramic tile and metal door frames and between ceramic tile and marble thresholds.
3. Control joints shall also be located directly over joints in concrete slabs. Joints shall be in accordance with the "Handbook for Ceramic Tile Installation" of the Tile Council of America, EJ171-06. Base/cove installation shall be "Flush" as indicated in the "Handbook for Ceramic tile Installation."
4. All control joints shall be left open, protected, and maintained clean to receive the control joint sealant and backing.
5. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

H. Marble Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-portland cement mortar (thin set).
2. Do not extend cleavage membrane waterproofing or crack isolation membrane under thresholds set in dry-set or latex-portland cement mortar. Fill joints between such thresholds and adjoining tile set on cleavage membrane waterproofing or crack isolation membrane with elastomeric sealant.

I. Metal Edge Strips: Install [at locations indicated and where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.

3.4 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.5 CRACK ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

3.6 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and hazes from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.7 TILE INSTALLATION SCHEDULE

A. Ceramic tile installation shall be in accordance with the following methods from the “Handbook For Ceramic Tile Installation," of the Tile Council of America, Inc., Latest Edition:

1. Thin-set floor: F113 with wet-cured, Latex-Portland cement/sand grout (1 pc = 1 sand) with crack protection sheet

2. Thin set with waterproofing membrane: F111, provide at second floor toilet rooms.
3. Thin-set, wall: W243.
4. Threshold: TH611.

B. All work shall be laid out to minimize cutting. Where cutting is required, tile shall be neatly cut and fitted with edges ground smooth.

C. Reinforce setting beds over waterproofing and cleavage membranes with the specified mesh reinforcing. Do not install tile floors over membrane until the membrane has been tested and accepted.

D. Apply silicone sealant at top edge of ceramic and quarry base between wall surface and base.

E. Use a grout release coating product as approved by the tile manufacture.

F. Limits of tile:

1. Extend tile into recesses and under equipment and fixtures to form a complete covering without interruption.
2. Terminate tile neatly at obstructions, edges, and corners, without disruption of pattern or joint alignment.
3. Use bullnose shapes to terminate tile except at inside corners.

END OF SECTION 09.3000

SECTION 09.3050 – METAL COVE BASE & TRIM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Edge-protection and transition profiles for floors.

B. Finishing and edge-protection profiles for walls and countertops.

C. Movement joint and cove-shaped profiles.

1.2 RELATED SECTIONS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 06 10 00 - Rough Carpentry.

C. Section 07 90 00 - Joint Protection.

D. Section 09 28 13 - Cementitious Backing Boards.

E. Section 09 30 00 - Tiling.

F. Section 09 30 00 - Tiling. Shower trays, curbs, ramps, bench, niche, sealing compound, waterproofing membrane, drainage panels, drainage membrane compatible with floor drains.

G. Section 10 26 13 - Corner Guards.

H. Section 22 13 19.13 - Sanitary Drains.

I. Section 08 90 00 - Radiant Heating Units.

1.3 REFERENCES

A. CSA B79-08: Floor, Area, and Shower Drains, and Cleanouts for Residential Construction.

B. IAPMO IGC 195: Interim Guide Criteria for Floor Drain with Integrated Bonding Flange.

C. Tile Council of North America (TCNA) Handbook for Ceramic Tile Installation.

D. Terrazzo, Tile and Marble Association of Canada (TTMAC) Specification Guide 09300 Tile Installation Manual.

E. American National Standard Specifications for the installation of ceramic tile A108 / A118 / A136.1.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) long, representing actual product, color, and finish.

D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

E. Warranty document showing duration and scope to be submitted with product submittals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years' experience.

B. Source Limitations for Setting Materials and Accessories: Obtain product of a uniform quality for each application condition from a single manufacturer.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
1. Finish areas designated by Architect.
2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
3. Refinish mock-up area as required to produce acceptable work.

D. Preinstallation Conference: Conduct conference at the Project site.
1. Convene one week prior to commencing work of this section.
2. Require attendance of installation material manufacturer, tile supplier, tile installer and installers of related work. Review installation procedures and coordination required with related work.
3. Meeting agenda includes but is not limited to:
    a. Surface preparation.
    b. Tile and installation material compatibility.
    c. Manufacturer and installer warranty duration and scope covered by warranty.
    d. Edge protection, transition, and pre-fabricated movement joint profiles.
    e. Waterproofing techniques.
    f. Crack isolation techniques.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.

C. Store materials in a dry, warm, ventilated weathertight location.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits

recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 WARRANTY

A. Provide sample warranty during submittal process.

B. Acknowledge warranty duration and scope covered by warranty.

C. Coordinate Work with other operations and installation of floor finish materials to avoid damage to installed materials.

D. Obtain products of a uniform quality for each premanufactured tile profile, and mortar and waterproofing and uncoupling membrane from a single manufacturer, to maintain the installation system and provide multi-product warranty from selected manufacturer.

1.9 COORDINATION

A. Coordinate Work with other operations and installation of floor finish materials to avoid damage to installed materials.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Schluter Systems L.P., which is located at: 194 Pleasant Ridge Road.; Plattsburgh, NY 12901-5841; ASD Toll Free Tel: 800-472-4588; Fax: 800-477-9783; Email: specassist@schluter.com; Web: www.schluter.com/schluter-us/en_US/.

B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

2.2 EDGE-PROTECTION AND TRANSITION PROFILES FOR FLOORS

A. Schluter-DECO: Profile with 1/4 inch (6 mm) wide visible surface and integrated trapezoid-perforated anchoring leg.
   1. Profile Height: As required to coordinate with tile selection and setting system.
   2. Material and Finish:
      a. E: Stainless Steel Type 304 equals V2A.

2.3 FINISHING AND EDGE-PROTECTION PROFILES FOR WALLS AND COUNTERTOPS

A. Schluter-JOLLY: L-shaped profile. 9/64 inch (3.5 mm) wide top and vertical wall sections that together form the visible surface. Integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
   1. Corners: Matching inside corners.
   2. Corners: Matching outside corners.
   3. Anchoring Leg: Straight anchoring leg.
   4. Profile Height: As required to coordinate with tile selection and setting system.
   5. Material and Finish:
      a. EB: Brushed Stainless Steel 304 / V2A.

B. Schluter-SCHIENE: L-shaped profile with 1/8 inch (3.2 mm) wide visible surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
   1. Anchoring Leg: Straight anchoring leg.
   2. Profile Height: As required to coordinate with tile selection and setting system.
   3. Material and Finish:
      a. EV4A: Stainless Steel Type 316 L equals V4A.

C. Schluter-QUADEC: Profile with square visible surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
   1. Corners: Matching inside corners.
   2. Corners: Matching outside corners.
   3. Corners: Internal connectors.
   4. Profile Height: As required to coordinate with tile selection and setting system.
   5. Material and Finish:
      a. E: Stainless Steel Type 304 equals V2A.

2.4 MOVEMENT JOINTS AND COVE-SHAPED PROFILES (PTB-01)

A. Schluter-DILEX-HKS: Profile with integrated, roll-formed stainless steel with trapezoid-perforated anchoring legs, connected at a 90-degree angle by a stainless steel cove-shaped section with 23/32 inch (18.5 mm) radius and 1/2 inch (12.5 mm) wide thermoplastic rubber movement zone, which together form the visible surface. Available in gray only.
   1. Corners: Matching inside corners.
   2. Corners: Matching outside corners.
   3. Corners: Matching end caps.
   4. Corners: Matching connectors.
   5. Profile Height: As required to coordinate with tile selection and setting system.
   6. Material and Finish:
      a. E: Stainless Steel Type 304 equals V2A.
   7. Movement Zone Color:
      a. PG: Classic Grey.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 09.3050

SECTION 09.5100 - ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general conditions of Contract, including General and Supplementary Conditions and Divisions-1 Specification sections apply to work of this section.

1.2 SUMMARY

A. This Section includes the following:
   1. Acoustical panels and exposed suspension systems for ceilings, with panels of the following types:
      a. Standard mineral fiber acoustical panels.
      b. Exposed grid suspension system
      c. Wire hangers, fasteners, main runners, cross tees, and wall angle moldings
      d. Perimeter Trim.

B. Related Sections include the following:
   1. Division 9 Section “Gypsum Board Assemblies”
   2. Divisions 23 - HVAC Air Distribution
   3. Division 26 – Electrical

C. Alternate manufacturers will be considered subject to the provisions of Division 01 – Substitutions.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
   2. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
   3. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
   4. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
   5. ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
   6. ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
   7. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber

8. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
9. ASTM E 119 Standard Test Methods for Fire Tests of Building Construction and Material
    a. Armstrong Fire Guard Products
10. ASTM E 580 Installation of Metal Suspension Systems in Areas Requiring Moderate Seismic Restraint
11. ASTM E 1111 Standard Test Method for Measuring the Interzone Attenuation of Ceilings Systems
12. ASTM E 1414 Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum
13. ASTM E 1264 Classification for Acoustical Ceiling Product

B. International Building Code

C. C. ASHRAE Standard 62.1-2004, Ventilation for Acceptable Indoor Air Quality

D. D. NFPA 70 National Electrical Code

E. ASCE 7 American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures

F. International Code Council-Evaluation Services - AC 156 Acceptance Criteria for Seismic Qualification Testing of Non-structural Components

G. International Code Council-Evaluation Services Report - Seismic Engineer Report
    1. ESR 1308 - Armstrong Suspension Systems

H. International Association of Plumbing and Mechanical Officials - Seismic Engineer Report
    1. 0244 - Armstrong Single Span Suspension System

I. California Department of Public Health CDPH/EHLB Emission Standard Method Version 1.1 2010

J. LEED - Leadership in Energy and Environmental Design is a set of rating systems for the design, construction, operation, and maintenance of green buildings

K. International Well Building Standard

L. Mindful Materials

M. Living Building Challenge

N. U.S. Department of Agriculture BioPreferred program (USDA BioPreffered)

1.4 SYSTEM DESCRIPTION

A. Continuous/Wall-to-Wall

1.5 SUBMITTALS

A. Product Data: Product Data: Submit manufacturer's technical data for each type of acoustical ceiling unit and suspension system required.

B. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
   1. Ceiling suspension members.
   2. Method of attaching hangers to building structure.
      a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
   3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
   4. Minimum Drawing Scale: 1/4 inch = 1 foot.

C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
   1. Acoustical Panels: Minimum 6 inch x 6 inch samples of specified acoustical panel.
   2. Wood Panels: Set of 12-inch square Samples with specified wood species, pattern and finish.
   3. Exposed Suspension System Members, Moldings, and Trim, including main runner and 4 foot cross tees: Set of 12-inch-long Samples of each type, finish, and color.

D. Acoustical Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. For acoustical performance, each carton of material must carry an approved independent laboratory classification of NRC, CAC, and AC.
   1. If the material supplied by the acoustical subcontractor does not have an Underwriter's Laboratory classification of acoustical performance on every carton, subcontractor shall be required to send material from every production run appearing on the job to an independent or NVLAP approved laboratory for testing, at the architect's or owner's discretion. All products not conforming to manufacturer's current published values must be removed, disposed of and replaced with complying product at the expense of the Contractor performing the work.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.

1. Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.
2. Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with ASTM E 1264 Classification.
3. Fire Resistance: As follows tested per ASTM E119 and listed in the appropriate floor or roof design in the Underwriters Laboratories Fire Resistance Directory.

B. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:
1. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings--Seismic Zones 0-2."

C. Coordination of Work: Coordinate acoustical ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Coordination: Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

C. Space Enclosure:
1. HumiGuard Plus Ceilings: Building areas to receive ceilings shall be free of construction dust and debris. Products with HumiGuard Plus performance and hot

dipped galvanized steel, aluminum or stainless steel suspension systems can be installed up to 120°F (49°C) and in spaces before the building is enclosed, where HVAC systems are cycled or not operating. Cannot be used in exterior applications where standing water is present or where moisture will come in direct contact with the ceiling.

2. HumiGuard Max Ceilings: Building areas to receive ceilings shall be free of construction dust and debris. Ceilings with HumiGuard Max performance can be installed in conditions up to 120°F (49°C) and maximum humidity exposure including outdoor applications, and other standing water applications, so long as they are installed with either SS Prelude Plus, AL Prelude Plus, or Prelude Plus Fire Guard XL suspension systems. Products with Humiguard Max performance can be installed in exterior applications, where standing water is present, or where moisture will come in direct contact with the ceiling. Only Ceramaguard with AL Prelude Plus suspension system can be installed over swimming pools.

1.9 WARRANTY

A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to the following:
   1. Acoustical Panels: Sagging and warping
   2. Grid System: Rusting and manufacturer's defects

B. Warranty Period:
   1. Acoustical panels: Ten (10) years from date of substantial completion
   2. Suspension: Ten (10) years from date of substantial completion
   3. Ceiling System: Thirty (30) years from date of substantial completion.

C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.10 EXTRA MATERIALS

A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.
   1. Acoustical Ceiling Units: Furnish quality of full-size units equal to 5.0 percent of amount installed.
   2. Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 2.0 percent of amount installed.
   3. Provide an additional 50 tiles of each type listed below above and beyond the 5.0 percent for replacement of damaged tiles during construction.

a. Types ACT-01 and ACT-02.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide ceiling products as follows:
1. Ceiling Panels: Armstrong World Industries, Inc.
2. Suspension Systems: Armstrong World Industries, Inc.
3. Perimeter Systems: Armstrong World Industries, Inc.

B. Subject to compliance with requirements, products of the following manufacturers may be considered:
1. CertainTeed Corp.
2. USG
3. Rockfon

2.2 ACOUSTIC CEILING TILES

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectance's, unless otherwise indicated.
1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.

B. Acoustical Panels **Type ACT-01**:
1. Surface Texture: Fine
2. Composition: Mineral Fiber
3. Color: White
4. Size: 24 in x 24 in
5. Thickness: 3/4"
6. Edge Profile: Square Lay-In 15/16 in for interface with PRELUDE XL 15/16" Exposed Tee grid.
7. Noise Reduction Coefficient (NRC): ASTM C 423; Classified with UL label on product carton 0.75
8. Ceiling Attenuation Class (CAC): ASTM C 1414; Classified with UL label on product carton 35
9. Sabin: N/A
10. Articulation Class (AC): 170
11. Flame Spread: ASTM E 1264; Class A (UL)
12. Light Reflectance (LR) White Panel: ASTM E 1477; 88%
13. Dimensional Stability: HumiGuard Plus+

14. Mold/Mildew Resistance: BIOBLOCK
15. Recycle Content: Post-Consumer - 0% - 1% Pre-Consumer - 75% - 76%
16. Material Ingredient Transparency: Health Product Declaration (HPD); Declare Label
17. Life Cycle Assessment: Third Party Certified Environment Product Declaration (EPD)
18. Acceptable Product: ULTIMA 1911HRC Tegular as manufactured by Armstrong World Industries.

C. Acoustical Panels Type **ACT-02:**
1. Surface Texture: Medium
2. Composition: Mineral Fiber
3. Color: White
4. Size: 24 in x 48 in
5. Thickness: 5/8”
6. Edge Profile: Square Lay-In 15/16 in for interface with PRELUDE Plus XL Fire Guard 15/16" Exposed Tee grid.
7. Noise Reduction Coefficient (NRC): N/A
8. Ceiling Attenuation Class (CAC): ASTM C 1414; Classified with UL label on product carton 40
9. Sabin: N/A
10. Articulation Class (AC): 170
11. Flame Spread: ASTM E 1264; Class A (UL); FIREGUARD
12. Light Reflectance (LR) White Panel: ASTM E 1477; 86%
13. Dimensional Stability: HumiGuard Max
14. Mold/Mildew Resistance: BioBlock
15. Recycle Content: Post-Consumer - 0% Pre-Consumer - 41%
16. Material Ingredient Transparency: Health Product Declaration (HPD); Declare Label
17. Life Cycle Assessment: Third Party Certified Environment Product Declaration (EPD)
18. Acceptable Product: CERAMAGUARD 605, as manufactured by Armstrong World Industries.

2.3 METAL SUSPENSION SYSTEMS GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.

1. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition; unless otherwise indicated.
2. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594; for ceilings located in wet areas as follows:
   a. Shower Areas and Dishwashing Areas: Alloy 304 or 316.
   b. Swimming Pool Areas: Alloy 316.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
1. Zinc-Coated Carbon-Steel Wire: ASTM A 641, Class 1 zinc coating, soft temper; unless otherwise indicated.
2. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400; for ceilings located in wet areas including shower areas, dishwashing areas and swimming pools.
3. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire but provide not less than 0.106-inch diameter wire.

2.4 METAL SUSPENSION SYSTEMS **ACT-01 and ACT-02**

A. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, hot-dip galvanized according to ASTM A 653, not less than G30 coating designation, with prefinished 15/16-inch-wide metal caps on flanges. Exposed surfaces chemically cleansed, capping prefinished galvanized steel in baked polyester paint. Main beams and cross tees shall have rotary stitching.
1. Structural Classification: Intermediate-duty system. ASTM C635.
2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
3. Face Design: Flat, flush.
4. Cap Materials:
   a. Typical Locations: Steel cold-rolled sheet.
   b. Wet Areas: Aluminum sheet; for acoustical ceilings located in bathrooms and shower areas.
   c. Areas Indicated for Scrubbable Panels: Aluminum sheet.
5. Cap Finish: Painted white to match acoustical panels.
6. Sustainability: Environmental Product Declaration (EPD), Health Product Declaration (HPD)
7. Acceptable Product: PRELUDE XL 15/16" Exposed Tee as manufactured by Armstrong World Industries.

B. Roll-Formed Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
1. #7800 - 12' Wall Molding

2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.5 Special Accessories for Acoustical Ceilings: Provide factory-prepared units as described below to accommodate installation conditions indicated, finished to match appearance of exposed suspension system members.

1. Accessory for Bullnose Concrete Masonry: Snap-over molding to trim outside corners, fitting over 1-inch radius masonry units.
   a. Product: Bullnose Corner Cover No. 7866; Armstrong.
2. Drywall Transition Clip: For transition from 5/8 inch gypsum board to acoustical ceiling; eliminates need for drywall bead.
   a. Product: DW58; Armstrong.
3. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees.
   a. Locations: Provide hold-down clips for acoustical ceilings located in Vestibules and Toilet Rooms, Showers, etc..

B. Supplemental Supports: In locations where building structural elements supporting ceiling suspension systems are spaced more than 48 inches o.c. and where obstructions or other conditions prevent support of ceiling suspension systems at 48 inches o.c. or less, provide cold-formed metal framing to support ceiling systems to comply with specified standards, with depth of supplemental framing members not less than the following:

1. Overhead Structural Support Spacing up to 4 Feet: 1-1/2 inches.
2. Overhead Structural Support Spacing Between 4 Feet and 6 Feet: 2-1/2 inches.
3. Overhead Structural Support Spacing Between 6 Feet and 10 Feet: 4 inches.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Custom Closures and Terminations: Provide trim and closures, of configurations indicated; matching exposed ceiling suspension system members.

1. Provide units complete with anchors for support to structure and installation of ceiling systems.
2. Provide units fabricated from aluminum plate, shapes and break metal as indicated.

C. Acoustical Sealant: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Pecora Corp.; BA-98.
   b. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.

c. Tremco, Inc.; Tremco Acoustical Sealant.
d. United States Gypsum Co.; SHEETROCK Acoustical Sealant.

D. Sound Attenuation Insulation: ASTM C 665, Type I (without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION, GENERAL

A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
1. Provide secondary restraint as required for acoustical panel ceilings.

B. Suspend ceiling hangers from building's structural members and as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
6. Do not attach hangers to steel deck tabs.
7. Do not attach hangers to steel roof deck or to bridging for roof joists or floor joists. Attach hangers to structural members.
8. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. Arrange directionally patterned acoustical panels as indicated on reflected ceiling plans.
2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges. Use of teg tabs at perimeter will not be accepted.

4. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

G. Install sound attenuation insulation on top of acoustical panels in locations indicated, according to insulation manufacturer's instructions.

H. Install suspended reveal ceiling systems by mechanically mounting panels to T-bar with 15/16 inch face flange at 1-1/2 inch web height.
1. Secure T-bar to factory-installed clips on panel backs, then hang the completed assembly in place using hanger wires or rods.
2. Handle panels only with clean, lightweight, white gloves.
3. Comply with panel manufacturer's printed instructions for installation, including requirements for field-cutting panels.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09.5000

SECTION 09.6513 - RESILIENT WALL BASE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Resilient Wall Base and accessories.
2. Substrate preparation.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 03.3000 - CAST-IN-PLACE CONCRETE for concrete substrate; slab surface tolerances;
2. Section 06.1000 - ROUGH CARPENTRY for plywood substrate and surface tolerances.

C. References (Industry Standards):

1. ASTM International (ASTM):
   a. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials
   b. ASTM E648 Standard Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
   c. ASTM E662 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
   d. ASTM F710 Standard Practice for Preparing Concrete to Receive Resilient Flooring
   e. ASTM F1861 Standard Specification for Resilient Wall Base
   f. ASTM F386 Standard Test Method for Thickness of Resilient Flooring Materials Having Flat Surfaces.
2. Canadian ULC Standards (CAN/ULC):
   a. CAN/ULC-S102.2 Surface Burning Characteristics

3. National Fire Protection Association (NFPA):
   a. NFPA 253 Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Energy Source
   b. NFPA 258 Test Method for Specific Density of Smoke Generated by Solid Materials

c. NFPA 255 Test Method of Test of Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures.

B. Product Data: Submit manufacturer's technical data sheet, care & maintenance document, submittal and/or warranty for each material and accessory proposed for use.

C. Samples for Initial Selection: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide resilient flooring materials manufactured in the United States of America by a firm with a minimum of 10 years' experience with resilient flooring materials of type equivalent to those specified.
   1. Manufacturer's quality management system must have ISO 9001:2000 approval.
   2. Provide resilient flooring products, including wall base, accessories and subfloor preparation products from one manufacturer to ensure color matching and compatibility.
   3. Manufacturer shall be capable of providing technical training and technical field service representation.

B. Installer Qualifications: Installer must be professional, licensed, insured and acceptable to manufacturer of resilient flooring materials. Project Managers or Field Supervisors must be INSTALL (International Standards & Training Alliance) certified, CFI (Certified Floorcovering Installers) Certified and/or an FCICA (The Flooring Contractors Association) CIM (Certified Installation Manager) for the requirements of the project.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in labeled packages. Store and handle in strict compliance with manufacturer's recommendations.

B. Deliver materials sufficiently in advance of installation to condition materials to the required temperature for 48-hours prior to installation

C. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by Johnsonite, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

1.6 PROJECT CONDITIONS

A. Install resilient products after other finishing operations, including painting, have been completed.

B. Maintain ambient temperatures within range recommended by the manufacturer, but not less than 65 deg F (18 deg C) or more than 85 deg F (29 deg C) in spaces to receive resilient products during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

C. Maintain the ambient relative humidity between 40% and 60% during installation.

D. Until Substantial Completion, maintain ambient temperatures within range recommended by the manufacturer, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

PART 2 - PRODUCTS

2.1 RESILIENT WALL BASE

A. Basis of Design Manufacturer:
   1. Johnsonite, Inc., 16910 Munn Road, Chagrin Falls, Ohio 44023;
      a. Phone: (800) 899-8916, (440) 543-8916
      b. Fax: (440) 543-8920
      c. Web: www.tarkettna.com
      d. E-mail: info@johnsonite.com

B. RUBBER WALL BASE – **RWB-01**
   1. Collection: Baseworks Thermoset Rubber (TSBT)
   2. Pattern: Toeless & Straight.
   3. Color: As indicated on the Drawings.
   4. Height: 4” and as indicated on the Drawings.
   5. Corners: Provide inside and outside preformed corners, 1/8” thick with 4" returns.
   6. Physical Characteristics:
      a. Manufactured from a proprietary thermoset rubber formulation.
      b. Meets performance requirements for ASTM F-1861, Type TS, Group 1.
      c. ASTM E 648, Standard Test Method for Critical Radiant Flux of 0.45 watts/cm^2 or greater, Class I.
      d. ASTM E 84, Standard Test Method for Surface Burning Characteristics of Building Materials, Class B, Smoke <450.

e. Flexibility: Does not crack, break, or show any signs of fatigue when bent around a 1/4" (6.4 mm) diameter cylinder when tested according to ASTM F 137 Standard Test Method for Flexibility of Resilient Flooring Materials protocols.
f. Color Stability: Meets or exceeds ASTM F 1861 requirements for color stability when tested to ASTM F 1515 Standard Test Method for Measuring Light Stability of Resilient Flooring protocols.
g. Phthalate, chlorine and halogen free.
h. 100% Recyclable.
i. SCS FloorScore® Certified and meets California Specifications Section 01350.
j. Contains 2.3% rapidly renewable content.

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based formulation manufactured and warranted by a reputable manufacturer.

B. Adhesives: as recommended by the manufacturer to meet site conditions.
1. Johnsonite 960 Cove Base Adhesive.
2. Johnsonite 946 Premium Contact Bond Adhesive.

C. Maintenance Products: As recommended by the manufacturer.

PART 3 - EXECUTION

3.1 GENERAL

A. General Contractor's Responsibilities:

1. Supply a safe, climate controlled building and subfloor as detailed in Technical Data Sheets.
2. Ensure substrate meets the requirements of ASTM F710, Technical Data Sheets and Excelsior Technical Data Sheets.
3. Ensure horizontal concrete substrates have been tested per ASTM F2170 and/or ASTM F1869 to confirm that concrete relative humidity and/or moisture vapor emission rates are within tolerance of the approved adhesive.
4. Confirm the porosity of all substrates to ensure proper adhesive usage.
5. Provide a secure storage area that is maintained permanently or temporarily at normal operating temperature and humidity conditions (except walk in freezers or similar) between 65° F and 85° F and between 40% and 65% relative humidity, for at least 48-hours prior to and during the application of the flooring, so the flooring contractor can acclimate the flooring materials per manufacturer's instructions.
6. Provide an installation area that is weather tight and maintained either permanently or temporarily at ambient service temperature and humidity (except walk in freezers or

similar), normal operating temperature and humidity conditions (except walk in freezers or similar) between 65° F and 85° F and between 40% and 65% relative humidity, for at least 48-hours prior to and during the application of the flooring per the manufacturer's instructions.

7. Ensure areas with direct prolonged exposure to sunlight are protected with protective UVA/UVB restrictive coatings or films.
8. Areas of the flooring that are subject to direct sunlight through doors or windows should have them covered using blinds, curtains, cardboard or similar for the time of the installation and 72-hours after the installation to allow the adhesive to cure. Note: These areas should be installed using wet adhesives only.
9. Protect newly installed flooring with construction grade paper or protective boards, such as Masonite or Ram Board, to prevent flooring damage, especially by other trades. Limit usage and foot traffic according to the adhesive's requirements. When moving appliances or heavy furniture, protect flooring from scuffing and tearing using temporary floor protection.
10. Ensure furniture casters are made of a soft material and have a contact point of at least 1" in width to limit indentation and flooring damage. All rolling chairs or seating must have a resilient flooring chair pad installed over the finished floor to protect floor covering. All fixed furniture legs must have permanent felt or soft rubber floor protectors installed on all contact points to reduce indentation. Floor protectors must have a flat contact point of at least 1" in width and must cover the entire bottom surface of the furniture leg.
11. Conduct initial maintenance prior to final usage per the Care & Maintenance Documents. Do not conduct initial maintenance until adhesive has cured per the adhesive technical data.

B. Flooring Contractor's Responsibilities:
   1. Provide trained installers that are professional, licensed, insured and acceptable to manufacturer of resilient flooring materials.
   2. Ensure installers or installation teams meet one of the following requirements:
      a. Have completed INSTALL (International Standards & Training Alliance) or CFI (Certified Floorcovering Installers) training programs and/or are certified by INSTALL or CFI.
      b. Are being supervised by Project Managers or Field Supervisors that are INSTALL (International Standards & Training Alliance) certified, CFI (Certified Floorcovering Installers) Certified and/or an FCICA (The Flooring Contractors Association) CIM (Certified Installation Manager).
   3. Follow all requirements in the appropriate Excelsior Technical Data Sheets, Care & Maintenance Documents, Warranties and other technical documents or instructions.

3.2 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Ensure substrate meets the requirements of ASTM F710, Technical Data Sheets and Excelsior Technical Data Sheets. Substrates must be free of visible water or moisture, dust, sealers, paint, sweeping compounds, curing compounds, residual adhesives and adhesive removers, concrete hardeners or densifiers, solvents, wax, oil, grease, asphalt, visible alkaline salts or excessive efflorescence, mold, mildew and any other extraneous coating, film, material or foreign matter

B. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient wall base.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Vacuum clean substrates to be covered by resilient products immediately before installation.

3.4 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. Preformed corners: Install preformed corners before installing straight pieces.

G. Job-formed corners:

1. Provide manufacturer's factory-made inside and outside corners matching wall base in material, color, height, and profile where available. Where matching factory-made corners are unavailable, form corners from wall base in accordance with manufacturer's written instructions and as follows:
    a. Outside corners: Form by bending without producing discoloration (whitening) at bends.
    b. Inside corners: Butt one piece to corner then scribe next piece to fit.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturers written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:
    1. Remove adhesive and other blemishes from exposed surfaces.
    2. Damp-mop surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

END OF SECTION 09.65.13

SECTION 09.6519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Flooring and accessories as shown on the drawings and schedules and as indicated by the requirements of this section.
    a. Solid vinyl floor tile.
    b. Rubber floor tile.

B. Related Documents:
1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

C. Related Sections:
1. Other Division 9 sections for floor finishes related to this section but not the work of this section
2. Division 3 Concrete; not the work of this section
3. Division 6 Wood and Plastics; not the work of this section
4. Division 7 Thermal and Moisture Protection; not the work of this section.

1.3 REFERENCES

A. ASTM International:
1. ASTM E 648 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
2. ASTM E 662 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
3. ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
4. ASTM F 1066 Standard Specification for Vinyl Composition Tile
5. ASTM F 1482, Standard Guide to Wood Underlayment Products Available for Use Under Resilient Flooring

6. ASTM F 1861 Standard Specification for Resilient Wall Base
7. ASTM F 1869 Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
8. ASTM F 2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

B. National Fire Protection Association (NFPA):
1. NFPA 253 Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
2. NFPA 258 Standard Test Method for Measuring the Smoke Generated by Solid Materials

C. Canadian Standards
1. CAN/ULC-S102.2 Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies.

1.4 SYSTEM DESCRIPTION

A. Performance Requirements: Provide flooring which has been manufactured, fabricated, and installed to performance criteria certified by manufacturer without defects, damage, or failure.

B. Administrative Requirements:
1. Pre-installation Meeting: Conduct an on-site pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Division 1 Project Management and Coordination (Project Meetings) Section.
2. Pre-installation Testing: Conduct pre-installation testing as follows:
   a. Moisture Tests
   b. Bond Test
   c. pH Test

C. Test Installations/Mock-ups: Install at the project site a job mock-up using acceptable products and manufacturer approved installation methods, including concrete substrate testing. Obtain Owner's and Consultant's acceptance of finish color, texture and pattern, and workmanship standards.
1. Mock-Up Size: 10'X10'
2. Incorporation: Mock-up may be incorporated into the final construction with Owner's approval.

D. Sequencing and Scheduling:
1. Install flooring and accessories after the other finishing operations, including painting, have been completed. Close spaces to traffic during the installation of the flooring.

2. Do not install flooring over concrete slabs until they are sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond, moisture tests and pH test.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Submit shop drawings, seaming plan, coving details, and manufacturer's technical data, installation and maintenance instructions for flooring and accessories.

C. Submit full size samples of each color for flooring and applicable accessories.

D. Submit Safety Data Sheets (SDS) available for adhesives, moisture mitigation systems, primers, patching/leveling compounds, floor finishes (polishes) and cleaning agents and Material Information Sheets for flooring products.

E. If required, submit the manufacturer's certification that the flooring has been tested by an independent laboratory and complies with the required fire tests.

F. Closeout Submittals: Submit the following:
1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.
2. Warranty: Warranty documents specified herein

1.6 QUALITY ASSURANCE

A. Single-Source Responsibility: provide types of flooring and accessories supplied by one manufacturer, including moisture mitigation systems, primers, leveling and patching compounds, and adhesives.

B. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

2. Confirm installer's certification by requesting their credentials.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Coordinate mockups in this Section with mockups specified in other Sections.

a. Size: Minimum 100 sq. ft. (9.3 sq. m) for each type, color, and pattern in locations directed by Architect.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.+

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays..

B. Deliver materials in good condition to the jobsite in the manufacturer's original unopened containers that bear the name and brand of the manufacturer, project identification, and shipping and handling instructions.

C. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces. Store flooring, adhesives, and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.

1.8 FIELD CONDITIONS

A. Maintain a minimum temperature in the spaces to receive the flooring and accessories of 65º F (18º C) and a maximum temperature of [100º F (38º C)] for at least 48 hours before, during, and for not less than 48 hours after installation. Thereafter, maintain a minimum temperature of 55º F (13º C) in areas where work is completed. Protect all materials from the direct flow of heat from hot-air registers, radiators, or other heating fixtures and appliances. Refer to product installation recommendations for a complete guide on project conditions Close spaces to traffic during floor tile installation.

B. Close spaces to traffic for 48 hours after floor tile installation.

C. Install floor tile after other finishing operations, including painting, have been completed.

1.9 LIMITED WARRANTY

A. Resilient Flooring: Submit a written warranty executed by the manufacturer, agreeing to repair or replace resilient flooring that fails within the warranty period.

B. Limited Warranty Period: 20 years

C. Limited Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

D. For the Limited Warranty to be valid, this product is required to be installed using the appropriate Manufacturer's Installation System. Product installed not using the specific instructions from the Manufacturer's Installation System will void the warranty.

1.10 MAINTENANCE

A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials from same production run as products installed. Packaged with protective covering for storage and identified with appropriate labels.
   1. Quantity: Furnish quantity of flooring units equal to 5 % of amount installed.
   2. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage, and protection of extra material.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.

   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
   2. Smoke Density: ASTM E662; maximum specific optical density of 450 or less.

2.2 LUXURY VINYL FLOOR TILE – **LVT-01**

A. Manufacturer: Basis of Design: Mohawk, Hot & Heavy Collection as indicated on the Drawings.

B. Tile Standard: ASTM F1700.

   1. Class: Class II, Surface-Decorated Vinyl Tile.

2. Type: B, Embossed Surface.

C. Thickness: 0.100 inch (2.5 mm).

D. Size: 18 by 36 inches (457 by 914 mm).

E. Colors and Patterns: As indicated by manufacturer's designations on the Drawings.

2.3 RUBBER FLOOR TILE – **RSF-02 & RSF-03**

A. Manufacturer: Basis of Design: Mannington Commercial, Teles Rubber Tile as indicated on the Drawings.

B. Tile Standard: ASTM F1344, Class I-B, Homogeneous Rubber Tile, through mottled.

C. Hardness: Grade 1, minimum hardness of 85 when measured using Shore, Type A durometer according to ASTM D2240.

D. Wearing Surface: Smooth.

E. Thickness: 0.125 inch (3.2 mm).

F. Size: 35.0 by 35.0 inches (899 by 899 mm).

G. Colors and Patterns: As indicated on the Drawings.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

1. <Double click to insert sustainable design text for flooring adhesive.>
2. <Double click to insert sustainable design text for adhesives.>

C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

2.5 ACCESSORIES

A. For patching, smoothing, and leveling monolithic subfloors concrete, provide manufactures recommended leveling compound as required for smooth surface to receive flooring.

B. For creating a moisture barrier, provide S-462 Seal Strong™ two-part moisture mitigation system.

C. For sealing joints between the top of wall base or integral cove cap and irregular wall surfaces such as masonry, provide plastic filler applied according to the manufacturer's recommendations.

D. Provide transition/reducing strips tapered to meet abutting materials.
1. Cap for cove carpet
2. Cap for cove resilient sheet floor covering
3. Carpet edge for glue-down applications
4. Nosing for carpet
5. Nosing for resilient floor covering
6. Reducer strip for resilient floor covering
7. Joiner for tile and carpet.

E. Provide threshold of thickness and width as shown on the drawings.

F. Provide resilient edge strips of width shown on the drawings, of equal gauge to the flooring, homogeneous vinyl, or rubber composition, tapered or bullnose edge, with color to match or contrast with the flooring, or as selected by the Architect from standard colors available.

G. Provide metal edge strips of width shown on the drawings and of required thickness to protect exposed edges of the flooring. Provide units of maximum available length to minimize the number of joints. Use butt-type metal edge strips for concealed anchorage or overlap-type metal edge strips for exposed anchorage. Unless otherwise shown, provide strips made of extruded aluminum with a mill finish.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including technical bulletins, product catalog, installation instructions, and product carton instructions for installation and maintenance procedures as needed.

3.2 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions (i.e., moisture tests, bond test, pH test, etc.).

B. Visually inspect flooring materials, adhesives, and accessories prior to installation. Flooring material with visual defects shall not be installed and shall not be considered as a legitimate claim.

C. Examine subfloors prior to installation to determine that surfaces are smooth and free from cracks, holes, ridges, and other defects that might prevent adhesive bond or impair durability or appearance of the flooring material.

D. Inspect subfloors prior to installation to determine that surfaces are free from curing, sealing, parting and hardening compounds; residual adhesives; adhesive removers; and other foreign materials that might prevent adhesive bond. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.

E. Report conditions contrary to contract requirements that would prevent a proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.

F. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the subfloor. Installation indicates acceptance of substrates regarding conditions existing at the time of installation.

3.3 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing.
4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m) and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

F. Concrete pH Testing: Perform pH tests on concrete floors regardless of their age or grade level. All test results shall be documented and retained.

3.4 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile. Failure to comply may result in voiding the manufacturer’s warranty listed in Paragraph 1.9.

B. Install flooring wall to wall before the installation of floor-set cabinets, casework, furniture, equipment, movable partitions, etc. Extend flooring into toe spaces, door recesses, closets, and similar openings as shown on the drawings.

C. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles in pattern(s) indicated on the Drawings.

D. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

E. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

F. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

H. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

I. Install flooring with adhesives, tools, and procedures in strict accordance with the manufacturer's written instructions. Observe the recommended adhesive trowel notching, open times, and working times.

3.5 INSTALLATION OF ACCESSORIES

A. Apply top set wall base to walls, columns, casework, and other permanent fixtures in areas where top-set base is required. Install base in lengths if practical, with inside corners fabricated from base materials that are mitered or coped. Tightly bond base to vertical substrate with continuous contact at horizontal and vertical surfaces.

B. Fill voids with plastic filler along the top edge of the resilient wall base or integral cove cap on masonry surfaces or other similar irregular substrates.

C. Place resilient edge strips tightly butted to flooring, and secure with adhesive recommended by the edge strip manufacturer. Install edge strips at edges of flooring that would otherwise be exposed.

3.6 CLEANING AND PROTECTION

A. Perform initial and on-going maintenance according to the latest edition of the Maintenance Instructions for Vinyl Composition Tile.

B. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

C. Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

D. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

E. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.

1. Apply two coat(s).

F. Cover floor tile until Substantial Completion.

END OF SECTION 09.6519

SECTION 09.6566 - RESILIENT ATHLETIC FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interlocking, Athletic Rubber Floor Tile.

1.3 REFERENCES

A. ASTM International:
1. ASTM E 648 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
2. ASTM E 662 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
3. ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
4. ASTM F 1066 Standard Specification for Vinyl Composition Tile
5. ASTM F 1482, Standard Guide to Wood Underlayment Products Available for Use Under Resilient Flooring
6. ASTM F 1861 Standard Specification for Resilient Wall Base
7. ASTM F 1869 Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
8. ASTM F 2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

B. National Fire Protection Association (NFPA):
1. NFPA 253 Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
2. NFPA 258 Standard Test Method for Measuring the Smoke Generated by Solid Materials

C. Canadian Standards:
1. CAN/ULC-S102.2 Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies.

1.4 SYSTEM DESCRIPTION

A. Performance Requirements: Provide Vulcanized Composition Rubber resilient flooring, which has been manufactured and installed to maintain performance criteria stated by manufacturer without defects, damage, or failure.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product, , including manufacturer's guide specifications product roll or tile, for specified products.

B. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including anchorage, accessories, finish colors, patterns, and textures.

C. Samples: For each exposed product and for each type, color, and pattern specified, 6-inch-(150-mm-) square in size and of the same thickness indicated for the Work.

D. Samples for Initial Selection: For each type of resilient athletic flooring.

E. Samples for Verification: For each type, color, and pattern of flooring specified, 6-inch- (150-mm) square in size and of same thickness and material indicated for the Work.

1.6 INFORMATIONAL SUBMITTALS

A. Installer Qualification Data:
   1. Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.

B. Manufacturer Qualification Data:
   1. Manufacturer capable of providing field service representation during construction and approving application method.

1.7 QUALITY ASSURANCE

A. Quality Assurance Submittals: Submit the following:
   1. Certificates: If required, certification of performance characteristics specified in this document shall be provided by the manufacturer.
   2. Manufacturer's Instructions: Manufacturer's installation instructions.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance Data: For resilient athletic flooring to include in maintenance manuals.

1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operational Data) Section. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
2. Warranty: Warranty documents specified herein.

1.9 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish extra floor tiles equal to 5 percent of the quantity installed for each type, color, pattern, and size. Provide each quantity in unopened, full boxes, rounded up to the next full box.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storing.

B. Store materials to prevent deterioration.

1. Store materials at temperature and humidity conditions recommended by manufacturer and protect from exposure to harmful weather conditions.
2. Store tiles on flat surfaces.

1.11 FIELD CONDITIONS

A. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays

B. Adhesively Applied Products:
1. Maintain a stable room and subfloor temperature for a period of 48 hrs. prior, during and 48 hrs. after installation. Recommended range: 60°F to 86° F (16° C to 30° C).
2. After post installation period, maintain temperatures within range recommended in writing by manufacturer, but not less than 55° F (13° C) or more than 95° F (35° C).
3. Close spaces to traffic during flooring installation.
4. Close spaces to traffic for 48 hours after flooring installation unless manufacturer recommends longer period in writing.

C. Install flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

1. ECOsurfaces, 715 Fountain Ave., Lancaster, PA 17601; 833-888-1760. BOD.
2. Dinoflex Sport Mat, 8 mm, selected red-fleck color;
3. REGUPOL Aktiv, 5/16-inch thickness, selected red-fleck color.

2.2 INTERLOCKING, RUBBER FLOOR TILE - **RSF-01**

A. Description: ECOsurfaces athletic flooring consisting of modular Vulcanized Composition Rubber Resilient Flooring and adhesives for commercial applications.
B. Material: ECOnights Vulcanized Composition Rubber resilient Interlocking Tile flooring.
C. Size: 23 inches (0.58m) square.
D. Thickness: 5/16 inch (8.0 mm).
E. Color and Pattern: As indicated on the Drawings.
F. Physical Properties:

Performance Criteria	Test Method	Typical Results
Tensile Strength	ASTM D412	200 psi
Flexibility	ASTM F137	Pass
Thermal Conductivity	ASTM C518	0.10 F-ft2-h/Btu
Recovery After Static Load (@400 psi)	ASTM F970 Modified	0.005”
Coefficient of Friction	ASTM D2047	> 0.8
FloorScore	CA 01350	Pass
Resistance to Light	ASTM F1515	Pass
Chemical Resistance	ASTM F925	Good, No Change
Abrasion Resistance	ASTM D3389	Pass
Flammability – Pill Test	ASTM D2859	Pass
Noise Reduction Coefficient (NRC)	ASTM C423	8mm: 0.10 6mm: 0.07
Impact Insulation Class (IIC)*	ASTM E492	8mm: 51 6mm: 49
Delta IIC*	ASTM E2179	8mm: 22 6mm: 20
Force Reduction	Deltec Field Tester	8mm: 10.4% 6mm: Not tested
Energy Restitution	Deltec Field Tester	8mm: 71.9% 6mm: Not tested
VOC Washington State IAQ Test	ASTM D5116	Pass
Sound Transmission Coefficient (STC)*	ASTM E90	8mm: 50 6mm: 50
Roll Dimensions	Manufacturer	3/8” [8 mm] x 4’ by 25’ [1.2 m x 7.62 m]; Custom: 1/4” [6 mm] in 4’ by 25’ [1.2m x 7.62 m]

Roll Tolerance Width	Manufacturer	+3/4" – 0" / +19mm – 0mm
Roll Tolerance Length	Manufacturer	+ 1% - 0"
Roll & Tile Tolerance Thickness	Manufacturer	+/- 0.3 mm
Interlocking Tile Dimensions	Manufacturer	23" x 23" x 8mm (6mm custom)
Interlocking Tile Tolerance	Manufacturer	± 0.5% Length and Width

G. Source Quality: Obtain Vulcanized Composition Rubber resilient flooring materials from a single manufacturer.

2.3 ACCESSORIES

A. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by flooring manufacturer.

B. Adhesives: Water-resistant type recommended in writing by manufacturer for substrate and conditions indicated.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including technical bulletins, product catalog, installation instructions, and product carton instructions for installation and maintenance procedures as needed.

3.2 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Visually inspect flooring materials, adhesives, and accessories prior to installation. Flooring material with visual defects shall not be installed and shall not be considered as a legitimate claim.

C. Examine subfloors prior to installation to determine that surfaces are smooth and free from cracks, holes, ridges, and other defects that might prevent adhesive bond or impair durability or appearance of the flooring material.

D. Inspect subfloors prior to installation to determine that surfaces are free from curing, sealing, parting and hardening compounds; residual adhesives; adhesive removers; and other foreign materials that might prevent adhesive bond. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.

E. Report conditions contrary to contract requirements that would prevent a proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.

F. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the subfloor. Installation indicates acceptance of substrates regarding conditions existing at the time of installation.

G. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of flooring.

B. Concrete Substrates: Prepare according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing.
4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m) and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb. of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
    b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum [75] percent relative humidity level measurement.

C. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

D. Move flooring and installation materials into spaces where they will be installed at least 48 hours in advance of installation unless manufacturer recommends a longer period in writing.

1. Do not install flooring until it is the same temperature as space where it is to be installed.

E. Sweep and vacuum clean substrates to be covered by flooring immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 FLOORING INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions.

B. Scribe, cut, and fit flooring to butt neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.

C. Extend flooring into toe spaces, door reveals, closets, and similar openings unless otherwise indicated.

D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating subfloor markings on flooring. Use nonpermanent, nonstaining marking device.

3.5 FLOOR TILE INSTALLATION

A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles in pattern indicated.

B. Discard broken, cracked, chipped, or deformed tiles.

C. Tile Matching: Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged if so numbered.

D. Adhered Floor Tile: Adhere products to substrates using a full spread of adhesive applied to substrate to comply with adhesive and flooring manufacturers' written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.

1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.6 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing flooring installation:

1. Remove adhesive and other blemishes from flooring surfaces.
2. Sweep and vacuum flooring thoroughly.
3. Damp-mop flooring to remove marks and soil after time period recommended in writing by manufacturer.

B. Protect flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

1. Do not move heavy and sharp objects directly over flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 09.6566

SECTION 09.6710 – POURED THIN-FILM EPOXY FLOOR – EP-01

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes surface preparation and the application of paint systems.
   1. Fluid applied seamless flooring with all necessary accessories for complete installation.
   2. Preparation of flooring substrate.
   3. Accessories necessary for complete installation.
   4. Protection of adjacent materials and substrates.

B. Related Sections
   1. Cast-in-Place Concrete: Section 03.3000.
      a. Concrete sub-floor to be level (maximum variation not to exceed ¼ inch in 10 feet) and to have a steel troweled finish. No curing agents or other additives which could prevent bonding should be used unless the mechanical surface preparation method completely removes the curing agent residue or sealer.
      b. Slabs on grade must have an efficient puncture resistant vapor barrier placed directly under the slab.
   2. Joint Sealants: Section 07.9200.
   3. Gypsum Board: Section 09.2900.
   4. Adjacent floor finishes: Division 9.

1.2 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM) Publications:

B. C-307Test Method for Tensile Strength of Chemical-Resistant Mortars.

C. C-501Test Method for Relative Resistance to Wear Unglazed Ceramic Tile by the Taber Abraser.

D. C-531Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacing.

E. C-579Test Methods for Compressive Strength of Chemical-Resistant Mortars and Monolithic Surfaces.

F. C-580Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacing.

G. C-884Test Method for Thermal Compatibility Between Concrete and an Epoxy Resin Overlay.

H. D-570 Water Absorption of Plastics.

I. D-695 Compression Properties of Rigid Plastic.

1.3 DEFINITIONS

A. Epoxy Resin Flooring specified under this section is referenced on the drawings.

1.4 SYSTEM DESCRIPTION

A. System shall be a Thin-Film coating system shall consist of an epoxy primer and urethane topcoat. The finished floor system shall be 6-15 mils in thickness, dense, and nonporous with a gloss finish, Key #'s 450 & 467-HS.

1.5 SUBMITTALS

A. Samples: Submit 6 by 6 inch cured samples of flooring system indicating color combination and non-skid properties. Approved samples will be used during installation for product match.

B. Certified Test: Submit two copies of suppliers/ manufacturers written certification that flooring system meets or exceeds required properties.

C. Manufacturers Application Instructions: Submit descriptive data and specific recommendations for mixing, application, curing including any precautions of special handling instructions required to comply with the Occupational Safety and Health Act.

D. Shop Drawings: Shop Drawings shall be furnished showing installation of termination details, and details at floor material transitions and where adjoining equipment.

1. Locate and provide detailing for flexible joints required for flooring in area of installation.

E. Maintenance Instructions: Submit current copies of the flooring manufacturer's printed recommendations on maintenance methods and products. Submit in accordance with Section 01.7300 - Operation and Maintenance Manuals

1.6 QUALITY ASSURANCE

A. Obtain primary Epoxy/Urethane Coating System materials including primers, resins, hardening agents, specially blended aggregates, and finish coats from a single manufacturer

providing materials of the type specified in this section. Provide all secondary materials from a source recommended by the manufacturer of primary materials.

B. Installation shall be performed by an applicator with not less than ten years of satisfactory experience in the application of the type of system as specified in this section and shall be approved by the manufacturer of the Epoxy/Urethane Coating System.

C. Installer to verify locations of all joints requiring a soft sealant and/or epoxy joint material. Follow recommendations of material manufacture for treatment of all joints, expansion joints, and cracks.

D. Installer to keep daily log of the date of installation, room number, type, color, and method of application of product being installed. Log must be available for inspection by the Architect upon request.

E. Portable mock-up: Prior to starting application of coating system, provide full scale portable mock-up to establish acceptable quality, durability, and appearance. Mock-up size must not be less than 4 square feet.
   1. Acceptable mock-up to be standard of quality for installed work.
   2. Unacceptable installed work to be removed and replaced until acceptable. Aesthetically unacceptable but well bonded work may be recoated per Manufacturer's instructions if thickness clearances permit.

F. Qualifications:
   1. Installer: Must be acceptable to Architect, and Manufacturer.

1.7 PROJECT CONDITIONS

A. Maintain the ambient room and the floor temperatures at 60 degrees Fahrenheit, or above, for a period extending from 72 hours before, during and after floor installation. Concrete to receive surfacing shall have cured for at least 28 days and shall have been free of water for at least 7 days.

B. Dew Point: Substrate temperature must be minimum of 5 degrees above dew point prior to, during or up to 24 hours after application of flooring system.

C. Illumination: Apply flooring system only where a minimum of 30 footcandles exist when measured 3 feet from surface.

D. Advise other trades of fixtures and fittings not to be installed until flooring is cured and protected.

1.8 PROTECTION

A. Protect adjacent surfaces not scheduled to receive the flooring by masking, or by other means, to maintain these surfaces free of the flooring material.

B. B. Provide adequate ventilation and fire protection at all mixing and placing operations. Prohibit smoking or use of spark or flame producing devices within 50 feet of any mixing or placing operation.

C. C. Provide polyethylene or rubber gloves or protective creams for all workmen engaged in applying products containing epoxy.

1.9 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Primary system materials shall be delivered in the manufacturer's undamaged, unopened containers. Each container shall be clearly marked with the following:
   1. Product name
   2. Manufacturer's name
   3. Component designation (A or B, etc.)
   4. Mixing ratio of component mixture

B. Provide equipment and personnel to handle the materials by methods which prevent damage.

C. The applicator shall promptly inspect all direct job site deliveries to assure that quantities are correct and that materials comply with requirements and are not damaged.

D. Store materials in accordance with manufacturer's instructions, with seals and labels intact and legible. Maintain temperatures within the required range. Do not use materials that have been stored for a longer period of time than the manufacturer's maximum recommended shelf life.

1.10 WARRANTY

A. Contractor to guarantee work under this Section to be free from defects of material and installation for the duration of the warranty period. Defects occurring during warranty period shall be repaired, in a manner satisfactory to the Owner and the Architect, at no additional cost to the Owner.
   1. Warranty Period: One (1) Year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Specifications and quality of design standard (basis of design) based on Key Resin Company: Key Thin-Film Coating System.
1. Key Resin Company: 888-943-4532, www.keyresin.com
2. System Designation: EP-01

B. System description: 2-Part Thin-Film coating system consisting of an epoxy primer and urethane topcoat with broadcast silica aggregate for non-skid texture.

C. Alternative manufacturers must have as a minimum the standards set forth in this specification and must be preapproved in accordance with project requirements.

2.2 MATERIALS

A. Color to be selected by architect from manufacturer's full range.

B. Prime Coat: Pigmented, Two component penetrating damp-proof epoxy.

C. Topcoat: Two component aliphatic urethane topcoat with Non-Skid Additive (NSA): Key #450 Urethane or #467-HS urethane.

PART 3 - EXECUTION

3.1 PREPARATION

A. Obtain Architect's approval of mock-up before installing flooring; see QUALITY ASSURANCE in PART 1.

B. Preparation of Surface:
1. Inspect surfaces to receive flooring and verify that condition is smooth and free from conditions that will adversely affect execution, permanence, or quality of work.
   a. Remove all projections, all debris detrimental to flooring system, and dirt, oil contaminates, grease, and surface coatings affecting bond.
2. Notify Architect or Owner in writing prior to commencing work of any conditions deemed unsatisfactory for the installation; installation of flooring materials is understood as acceptance of the substrate as satisfactory.
3. Concrete: The General Contractor shall be responsible for hiring an independent testing service to test for moisture content and moisture vapor emission rate; install no flooring over concrete until the concrete has been cured and is sufficiently dry to achieve

acceptable bond with flooring as determined by material manufacturer's recommended bond and moisture tests.

a. Effectively remove concrete laitance by steel shot blasting or other method approved by flooring manufacturer.
b. Concrete slab shall have an efficient puncture-resistant moisture vapor barrier 10 mils thick minimum placed directly under the concrete slab (for slab on grade). Testing must be done to verify that the moisture vapor emission rate of the slab does not exceed that as recommended by the manufacturer at time of installation of the flooring or at any future date. Moisture vapor emission and moisture content testing must conform with the requirements of ASTM F-1869-98 (Calcium Chloride Test) and ASTM F-2170-02 (Relative Humidity Probe Test). If test results show excessive levels of moisture content or vapor emission rate, installation shall not proceed until source of excessive moisture is identified and removed or corrected. If excessive moisture cannot be removed or prevented, apply manufacturer's recommended moisture vapor emission control material.
c. Treat cracks in concrete using manufacturer's recommended practices. Rout out crack and fill with rigid epoxy; Reinforce crack with fiberglass cloth.

3.2 INSTALLATION

A. Apply each component of the Epoxy/Urethane Coating System in compliance with manufacturer's installation instructions including mixing and application methods, recoat windows, cure times and environmental restrictions.

B. Route out all cracks (larger than hairline width) and fill with Key Crack Filler or other material approved by Manufacturer of floor materials. Reinforce crack with fiberglass cloth using Key #502 Primer or the epoxy used to fill the crack.

C. Apply pigmented epoxy primer per recommended coverage rates.

D. Urethane Top Coat: Apply one or two pigmented urethane top coats as needed to ensure full coverage and approved texture. Add non-skid grit (fine mesh) to urethane coating application to provide textured finish.
   1. Cure finish coat(s) to manufacturer's recommendations.

E. Obtain architect/engineer's approval of the system just after completion of the final coat, prior to completion of curing.

3.3 CURING AND PROTECTION

A. Cure High-Build Epoxy/Urethane Coating System materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of the application and prior to completion of the curing process.

B. Apply temporary protection until floor is fully cured. The General Contractor shall protect the finished floor from the time that the sub-contractor completes the work.

END OF SECTION 09.6710

SECTION 09.6720 – POURED EPOXY FLOOR – EP-02

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes surface preparation and the application of paint systems.
   1. Fluid applied seamless flooring with integral cove base.
   2. Joint, edge, and termination strips.
   3. Prior to installation of structural floor slab, advise General Contractor, in writing, of all requirements of concrete substrate regarding finish, level tolerance, and curing; see INSPECTION in Part 3.
   4. Locate all flexible joints required. See submittals below.
   5. Accessories necessary for complete installation.

B. Related Sections
   1. Cast-in-Place Concrete: Section 03.3000.
      a. Concrete sub-floor to be level (maximum variation not to exceed ¼ inch in 10 feet) and to have a steel troweled finish. No curing agents or other additives which could prevent bonding should be used unless the mechanical surface preparation method completely removes the curing agent residue or sealer.
      b. Slabs on grade must have an efficient puncture resistant vapor barrier placed directly under the slab.
   2. Joint Sealants: Section 07.9200.
   3. Gypsum Board: Section 09.2900.
   4. Adjacent floor finishes: Division 9.

1.2 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM) Publications:

B. C-307Test Method for Tensile Strength of Chemical-Resistant Mortars.

C. C-501Test Method for Relative Resistance to Wear Unglazed Ceramic Tile by the Taber Abraser.

D. C-531Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacing.

E. C-579Test Methods for Compressive Strength of Chemical-Resistant Mortars and Monolithic Surfaces.

F. C-580Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacing.

G. C-884Test Method for Thermal Compatibility Between Concrete and an Epoxy Resin Overlay.

H. D-570 Water Absorption of Plastics.

I. D-695 Compression Properties of Rigid Plastic.

1.3 DEFINITIONS

A. Epoxy Resin Flooring specified under this section is referenced on the drawings.

1.4 SYSTEM DESCRIPTION

A. System shall be 1/8 inch textured epoxy surfacing with broadcast aggregate to form a skid resistant surface. Surface finish shall be a two component, chemical resistant epoxy, Key Mortar SLT.

1.5 SUBMITTALS

A. Samples: Submit 6 by 6 inch cured samples of flooring system indicating color combination and non-skid properties. Approved samples will be used during installation for product match.

B. Certified Test: Submit two copies of suppliers/ manufacturers written certification that flooring system meets or exceeds required properties.

C. Manufacturers Application Instructions: Submit descriptive data and specific recommendations for mixing, application, curing including any precautions of special handling instructions required to comply with the Occupational Safety and Health Act.

D. Shop Drawings: Shop Drawings shall be furnished showing installation of cove base and termination details, and details at floor material transitions and where adjoining equipment.

1. Locate and provide detailing for flexible joints required for flooring in area of installation.

E. Maintenance Instructions: Submit current copies of the flooring manufacturer's printed recommendations on maintenance methods and products. Submit in accordance with Section 01.7300 - Operation and Maintenance Manuals

1.6 QUALITY ASSURANCE

A. Materials used in the floor surfacing shall be the products of a single manufacturer. Obtain primary resinous flooring materials, including primers, resins, hardening agents, and finish or sealing coats, from a single manufacturer. Provide secondary materials including underlayment, joint sealant, and repair materials only of type and from source recommended by manufacturer of primary materials.

B. Installation shall be performed by an applicator with minimum 10 years' experience in work of similar nature and scope. Installer must be approved by the manufacturer of the floor surfacing materials. The contractor shall furnish a written statement from the manufacturer that the installer is acceptable.

C. Installer to verify locations of all flexible joints required by the provisions of this Section and by the recommendations of the related material manufacturers.

1. Joint locations may or may not be shown in drawings.

2. Refer to drawings required under SUBMITTALS above.

D. Installer to keep daily log of the date of installation, room number, type, color, and method of application of product being installed. Log must be available for inspection by the Architect upon request.

E. Contractor to have proven experience with specified system.

F. Portable mock-up: Prior to starting application of flooring, provide full scale portable mock-up to establish acceptable quality, durability, and appearance. Mock-up size must not be less than 4 square feet.

1. Acceptable mock-up to be standard of quality for installed work.

2. Unacceptable installed work to be removed and replaced until acceptable. Aesthetically unacceptable but well bonded work may be overlaid or recoated per Manufacturer's instructions if thickness clearances permit.

G. Qualifications:

1. Installer: Must be acceptable to Architect, and Manufacturer.

1.7 PROJECT CONDITIONS

A. Maintain the ambient room and the floor temperatures at 60 degrees Fahrenheit, or above, for a period extending from 72 hours before, during and after floor installation. Concrete to receive surfacing shall have cured for at least 28 days and shall have been free of water for at least 7 days.

B. Dew Point: Substrate temperature must be minimum of 5 degrees above dew point prior to, during or up to 24 hours after application of flooring system.

C. Illumination: Apply flooring system only where a minimum of 30 footcandles exist when measured 3 feet from surface.

D. Advise other trades of fixtures and fittings not to be installed until flooring is cured and protected.

1.8 PROTECTION

A. Protect adjacent surfaces not scheduled to receive the flooring by masking, or by other means, to maintain these surfaces free of the flooring material.

B. B. Provide adequate ventilation and fire protection at all mixing and placing operations. Prohibit smoking or use of spark or flame producing devices within 50 feet of any mixing or placing operation.

C. C. Provide polyethylene or rubber gloves or protective creams for all workmen engaged in applying products containing epoxy.

1.9 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All materials shall be delivered to project site in original manufacturer's sealed containers including type of material, batch numbers, date of manufacture, and pertinent labels intact and legible.

B. Store materials in dry protected area at a temperature between 60° F to 80° F.

C. Follow all manufacturer's specific instructions and prudent safety practices for storage and handling.

1.10 WARRANTY

A. Contractor to guarantee work under this Section to be free from defects of material and installation for the duration of the warranty period. Defects occurring during warranty period shall be repaired, in a manner satisfactory to the Owner and the Architect, at no additional cost to the Owner.

1. Warranty Period: One (1) Year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Specifications and quality of design standard (basis of design) based on Key Resin Company: Key Mortar SLT

1. Key Resin Company: 888-943-4532, www.keyresin.com

2. System Designation: EP-02

B. System description: Heavy duty, three-component epoxy resin surfacing broadcast with silica aggregate for non-skid texture.

C. Alternative manufacturers must have as a minimum the standards set forth in this specification and must be preapproved in accordance with project requirements.

2.2 MATERIALS

A. Color to be selected by architect from manufacturer's full range.

B. Prime Coat: Two component penetrating damp-proof epoxy.

C. Epoxy Matrix
1. Two component, 100% solids epoxy matrix (Key #511) with blended self-leveling aggregate composition.

D. Broadcast Aggregates:
1. 50-70 mesh broadcast silica sand or broadcast quartz.

E. Grout Coat:
1. Two component epoxy grout coat: Key #520 or Key #511 pigmented.

F. Topcoat:
1. Two component aliphatic urethane topcoat: Key #450 Urethane or #467-HS urethane.

G. Cove Base: Two component epoxy cove paste, Key #510-CV with blended aggregates.

2.3 FINISHES

A. Color as selected by Architect or Owner from the manufacturer's standard colors.

B. Provide slip-resistant, cleanable, and textured finish. Finished work to match the approved mock-up.

PART 3 - EXECUTION

3.1 PREPARATION

A. Obtain Architect's approval of mock-up before installing flooring; see QUALITY ASSURANCE in PART 1.

B. Preparation of Surface:

1. Inspect surfaces to receive flooring and verify that condition is smooth and free from conditions that will adversely affect execution, permanence, or quality of work.

    a. Remove all projections, all debris detrimental to flooring system, and dirt, oil contaminates, grease, and surface coatings affecting bond.

2. Notify Architect or Owner in writing prior to commencing work of any conditions deemed unsatisfactory for the installation; installation of flooring materials is understood as acceptance of the substrate as satisfactory.

3. Concrete: The General Contractor shall be responsible for hiring an independent testing service to test for moisture content and moisture vapor emission rate; install no flooring over concrete until the concrete has been cured and is sufficiently dry to achieve acceptable bond with flooring as determined by material manufacturer's recommended bond and moisture tests.

    a. Effectively remove concrete laitance by steel shot blasting or other method approved by flooring manufacturer.

    b. Concrete slab shall have an efficient puncture-resistant moisture vapor barrier 10 mils thick minimum placed directly under the concrete slab (for slab on grade). Testing must be done to verify that the moisture vapor emission rate of the slab does not exceed that as recommended by the manufacturer at time of installation of the flooring or at any future date. Moisture vapor emission and moisture content testing must conform with the requirements of ASTM F-1869-98 (Calcium Chloride Test) and ASTM F-2170-02 (Relative Humidity Probe Test). If test results show excessive levels of moisture content or vapor emission rate, installation shall not proceed until source of excessive moisture is identified and removed or corrected. If excessive moisture cannot be removed or prevented, apply manufacturer’s recommended moisture vapor emission control material.

    c. Treat cracks in concrete using manufacturer's recommended practices. Rout out crack and fill with rigid epoxy; Reinforce crack with fiberglass cloth. Refer to section 3.02.B.

3.2 INSTALLATION

A. Install all floor materials in strict conformance with manufacturer's instructions.

B. Route out all cracks (larger than hairline width) and fill with Key Crack Filler or other material approved by Manufacturer of floor materials. Reinforce crack with fiberglass cloth using Key #502 Primer or the epoxy used to fill the crack.

C. Prime entire surface with recommended primer.

D. Integral Cove Base: Where scheduled, provide integral cove base formed from flooring over tile backerboard as specified under 09250 - Gypsum Drywall. Provide cove cap strip at top of base as recommended by flooring manufacturer and trowel material up wall to form smooth, integral transition and base 4-6 inches high unless otherwise indicated or scheduled.

E. Apply epoxy matrix and broadcast aggregate at rates recommended by the manufacturer to achieve the specified thickness.

F. Apply epoxy grout and Urethane seal coats to provide a uniform, dense surface.

G. Match finished work to approved samples, uniform in thickness, sheen, color, pattern and texture, and free from defects detrimental to appearance.

3.2 CURING AND PROTECTION

A. Cure resinous system materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of the application and prior to completion of the curing process.

B. The Contractor shall protect the finished floor from the time flooring installation is completed until Substantial Completion of the project.

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END OF SECTION 09.6720

SECTION 09.6723 - RESINOUS FLOORING

HYBRI-FLEX AB

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes the following:

1. Resinous flooring system as shown on the drawings and in schedules.

B. Related sections include the following:

1. Cast-in-Place Concrete, section 03 30 00
2. Concrete Curing, section 03 39 00

1.3 SYSTEM DESCRIPTION

A. The work shall consist of preparation of the substrate, the furnishing and application of a cementitious urethane based self-leveling seamless flooring system with flintshot natural quartz aggregate broadcast, pigmented epoxy resin broadcast and pigmented aliphatic resinous grout coat and topcoat.
B. The system shall have the color and texture as specified by the Owner with a nominal thickness of 1/4 inch. It shall be applied to the prepared area(s) as defined in the plans strictly in accordance with the Manufacturer's recommendations.
C. Cove base (if required) to be applied where noted on plans and per manufacturers standard details unless otherwise noted

1.4 SUBMITTALS

A. Product Data: Latest edition of Manufacturer's literature including performance data and installation procedures.
B. Manufacturer’s Safety Data Sheet (SDS) for each product being used.
C. Samples: A 3 x 3 inch square sample of the proposed system. Color, texture, and thickness shall be representative of overall appearance of finished system subject to normal tolerances.
A. Provide 4’x4’ mock-up to be approved in writing by owner.

1.5 QUALITY ASSURANCE

A. The Manufacturer shall have a minimum of 10 years experience in the production, sales, and technical
support of epoxy and urethane industrial flooring and related materials.
B. The Applicator shall have experience in installation of the flooring system as confirmed by the manufacturer in
all phases of surface preparation and application of the product specified.

C. No requests for substitutions shall be considered that would change the generic type of the specified System.
D. System shall be in compliance with requirements of United States Department of Agriculture (USDA),
Food, Drug Administration (FDA), and local Health Department.
E. System shall be in compliance with the Indoor Air Quality requirements of California section 01350 as verified by a qualified independent testing laboratory.
F. A pre-installation conference shall be held between Applicator, General Contractor and the Owner to review this specification, application procedure, quality control, inspection and acceptance criteria and production schedule.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping
1. All components of the system shall be delivered to the site in the Manufacturer's packaging, clearly identified with the product type and batch number.

B. Storage and Protection

1. The Applicator shall be provided with a dry storage area for all components. The area shall be between 50 F and 85 F, dry, out of direct sunlight and in accordance with the Manufacturer's recommendations and relevant health and safety regulations.
2. Copies of Safety Data Sheets (SDS) for all components shall be kept on site for review by the Engineer or other personnel.

C. Waste Disposal

1. The Applicator shall be provided with adequate disposal facilities for non-hazardous waste generated during installation of the system.

1.7 PROJECT CONDITIONS

A. Site Requirements

1. Application may proceed while air, material and substrate temperatures are between 50 F and 85 F providing the substrate temperature is above the dew point. Outside of this range, the Manufacturer shall be consulted.
2. The Applicator shall be supplied with adequate lighting equal to the final lighting level during the preparation and installation of the system.

B. Conditions of new concrete to be coated with cementitious urethane material.

1. Concrete shall be moisture cured for a minimum of 7 days and have fully cured for 14 days in accordance
with ACI-308 prior to the application of the coating system pending moisture tests. Outside of these
parameters manufacturer shall be consulted.
2. Concrete shall have a flat rubbed finish, float or light steel trowel finish (a hard steel trowel finish is neither necessary nor desirable).
3. Sealers and curing agents should not be used.
4. Concrete surfaces on grade shall have been constructed with a vapor barrier to protect against the effects of vapor transmission and possible delamination of the system.

C. Safety Requirements

1. The Owner shall be responsible for the removal of foodstuffs from the work area.
2. Non-related personnel in the work area shall be kept to a minimum.

1.8 WARRANTY

A. Sherwin-Williams warrants that material shipped to buyers at the time of shipment substantially free from material defects and will perform substantially to Sherwin-Williams HPF published literature if used in accordance with the latest prescribed procedures and prior to the expiration date.
B. Sherwin-Williams liability with respect to this warranty is strictly limited to the value of the material purchase. One-year standard material warranty.

PART 2 – PRODUCTS

2.1 FLOORING

A. System Designation: **RN-01 & RN-02**
B. Sherwin-Williams High Performance Flooring, Hybri-Flex AB (self leveling solid color broadcast quartz), epoxy resin broadcast and aliphatic resinous topcoat seamless flooring system.

1. System Materials:

a. Topping: Sherwin-Williams Poly-Crete SL resin, SL hardener and SL aggregate.
b. The broadcast aggregate shall be Sherwin-Williams Flintshot quartz aggregate.
c. Broadcast coat: Sherwin-Williams Resuflor Glaze epoxy-based, two-component resin and hardener.
d. Topcoat: Sherwin-Williams pigmented Accelera resin and hardener.
e. *Optional primer. See Application Guide.*

2. Patch Materials
a. Shallow Fill and Patching: Use Sherwin-Williams. Poly-Crete MD (up to ¼ inch).

b. Deep Fill and Sloping Material (over ¼ inch): Use Sherwin-Williams Poly-Crete WR or Cemlack UM.

2.2 MANUFACTURER

A. The Sherwin-Williams High Performance Flooring, 866-540-1299 swflooring@sherwin.com
Website: https://industrial.sherwin-williams.com/na/us/en/resin-flooring.html

B. Manufacturer of Approved System shall be single source and made in the USA.

C. Alternates must be approved 10 days prior to bid date.

2.3 PRODUCT REQUIREMENTS

A. Topping	Poly-Crete SL
1. Percent Reactive	100%
2. VOC	0 g/L
3. Bond Strength to Concrete ASTM D 4541	400 psi, substrates fails
4. Compressive Strength, ASTM C 579	9,000 psi
5. Tensile Strength, ASTM D 638	2,175 psi
6. Flexural Strength, ASTM D 790	5,076 psi
7. Impact Resistance @ 125 mils, MIL D-3134, No visible damage or deterioration	160 inch lbs

B. Broadcast Coat	Resuflor Glaze
1. Percent Reactive,	100 %
2. VOC	<8 g/L
3. Water Absorption, ASTM D 570	0.04 %
4. Tensile Strength, ASTM D 638	4,000 psi
5. Coefficient of thermal expansion ASTM D 696,	2 x 10^{-5} in/in/F
6. Flammability ASTM D-635	Self-Extinguishing
7. Flame Spread/ NFPA 101 ASTM E-84	Class A

C. Topcoat	ACCELERA
1. Percent Solids	100 %
2. VOC	0 g/L
3. Bond Strength to Concrete ASTM D 4541	400 psi, substrates fails
4. Hardness, Shore D ASTM D2240	70
5. Compressive Strength, ASTM C579	18,000 psi
6. Tensile Strength, ASTM D638	2,600 psi
7. Abrasion Resistance, ASTM D4060	27 mg loss

C-17 Wheel, 1,000 gm load, 1,000 cycles

8. Potlife @ 70 F — 7 – 10 minutes
9. Gloss (ASTM D523) 60° — 90
10. Static Coefficient of Friction* , ANSI B101.1 — >0.6
11. Dynamic Coefficient of Friction - Wet* , ANSI A326.3 — >0.4

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas and conditions, with Applicator present, for compliance with requirements for maximum moisture content, installation tolerances and other conditions affecting flooring performance.

1. Verify that substrates and conditions are satisfactory for flooring installation and comply with requirements specified.

3.2 PREPARATION

A. General

1. New and existing concrete surfaces shall be free of oil, grease, curing compounds, loose particles, moss,
algae growth, laitance, friable matter, dirt, and bituminous products.
2. Moisture Testing: Perform tests recommended by manufacturer and as follows.
. a. Perform anhydrous calcium chloride test ASTM F 1869-98. Application will proceed only when the vapor/moisture emission rates from the slab is less than and not higher than 20 lbs/1,000 sf/24 hrs.
   b. Perform relative humidity test using is situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 99% relative humidity level measurement.
   c. If the vapor drive exceeds 99% relative humidity or 20 lbs/1,000 sf/24 hrs then the Owner and/or Engineer shall be notified and advised of additional cost for the possible installation of a vapor mitigation system that has been approved by the manufacturer or other means to lower the value to the acceptable limit.
3. Mechanical surface preparation
   a. Shot blast all surfaces to receive flooring system with a mobile steel shot, dust recycling machine (Blastrac or equal). All surface and embedded accumulations of paint, toppings hardened concrete layers, laitance, power trowel finishes and other similar surface characteristics shall be completely removed leaving a bare concrete surface having a minimum profile of CSP 4-5 as described by the International Concrete Repair Institute.
   b. Floor areas inaccessible to the mobile blast machines shall be mechanically abraded to the same degree of cleanliness, soundness and profile using diamond grinders, needle guns, bush hammers, or other suitable equipment.
   c. Where the perimeter of the substrate to be coated is not adjacent to a wall or curb, a minimum 1/4 inch

key cut shall be made to properly seat the system, providing a smooth transition between areas. The
detail cut shall also apply to drain perimeters and expansion joint edges.

d. Cracks and joints (non-moving) greater than 1/8 inch wide are to be chiseled or chipped-out and repaired per manufacturer's recommendations.

4. At spalled or worn areas, mechanically remove loose or delaminated concrete to a sound concrete and
patch per manufactures recommendations.

3.3 APPLICATION

A. General

1. The system shall be applied in four distinct steps as listed below:
   a. Substrate preparation

   b. Topping/overlay application with quartz aggregate broadcast.
   c. Resin application with quartz aggregate broadcast.

   d. Topcoat application.
2. Prior to the application of any component of the system, the surface shall be dry and any remaining dust or loose particles shall be removed using a vacuum.
3. The handling, mixing and addition of components shall be performed in a safe manner to achieve the desired results in accordance with the Manufacturer's recommendations.
4. The system shall follow the contour of the substrate unless pitching or other leveling work has been specified by the Architect.
5. A neat finish with well-defined boundaries and straight edges shall be provided by the Applicator.

B. Topping

1. The topping shall be applied as a self-leveling system as specified by the Architect. The topping shall be applied in one lift with a nominal thickness of 1/8 inch.
2. The topping shall be comprised of three components, a resin, hardener and filler as supplied by the Manufacturer.
3. The hardener shall be added to the resin and thoroughly dispersed by suitably approved mechanical means. SL Aggregate shall then be added to the catalyzed mixture and mixed in a manner to achieve a homogenous blend.
4. The topping shall be applied over horizontal surfaces using ½ inch "v" notched squeegee, trowels or other systems approved by the Manufacturer.
5. Immediately upon placing, the topping shall be degassed with a loop roller.
6. Flintshot quartz aggregate shall be broadcast to rejection into the wet material at the rate of 0.8 lbs./sf. see Application Instructions for more detail as the timing and temperature for proper broadcasting into SL.
7. Allow material to fully cure. Vacuum, or sweep to remove all loose aggregate.

C. Broadcast Coat

1. The broadcast coat shall be comprised of two components, a resin, and hardener as supplied by the Manufacturer and mixed in the ratio of 2 parts resin to 1 part hardener.
2. The resin shall be added to the hardener and thoroughly mixed by suitably approved mechanical means.
3. The broadcast coat shall be applied over horizontal surfaces using squeegee and back rolled at the rate of 90 sf/gal.
4. Flintshot quartz aggregate shall be broadcast to excess into the wet material at the rate of 0.5 lbs./sf.
5. Allow material to fully cure. Vacuum, or sweep to remove all loose aggregate.

E. Topcoat

1. The topcoat shall be comprised of ACCELERA (LH, Regular, or EXT) pigmented resin and hardener mixed per the manufacturer's instructions.
2. The topcoat shall be applied using a flat squeegee and cross rolled with a 3/8 inch nap roller at the rate of 65 SF/kit.
3. The finished floor will have a nominal thickness of ¼ inch.

3.4 FIELD QUALITY CONTROL

A. Tests, Inspection

1. The following tests shall be conducted by the Applicator:
   a. Temperature
      1. Air, substrate, and dew point temperatures.
   b. Relative Humidity
      1. ACCELERA is impacted by humidity. Use LH version when below 30% RH.
   c. Coverage Rates
      1. Rates for all layers shall be monitored by checking quantity of material used against the area covered.

3.5 CLEANING AND PROTECTION

A. Cure flooring material in compliance with manufacturer's directions, taking care to prevent their contamination during stages of application and prior to completion of the curing process.
B. Remove masking. Perform detail cleaning at floor termination, to leave cleanable surface for subsequent work of other sections.

END OF SECTION 09.6723

SECTION 09.6813 - TILE CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Division 01 Specification Sections

1.2 SUMMARY

A. This section relates to carpet tile.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation methods and as follows:

1. Yarn: Textile manufacturer’s current ATMI certification report or evidence of current ATMI “E3” certification.
2. Carpet: Submit a cut sheet for all carpet types and carpet materials, indicating compliance with CRI Green Label Test Program VOC Limits.
3. Adhesives: Specified certification.
4. Certification of post-consumer recycled content for yarn, carpet backing, and separate cushions.

B. Shop Drawings: Show the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.
3. Type of subfloor.
4. Type of installation.
5. Pattern of installation.
6. Pattern type, location, and direction.
7. Pile direction.
8. Type, color, and location of insets and borders.
9. Type, color, and location of edge, transition, and other accessory strips.
10. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.
2. Exposed Edge Stripping and Accessory: 12-inch- (300-mm-) long Samples.

D. Product Schedule: Use same room and product designations indicated on Drawings and in schedules.
E. Product Certificates: Submit manufacturers' certifications or cut sheets for all carpet types and components indicating compliance with specified requirements, including requirements for the percentages of post-industry recycled content and post-consumer recycled content.

F. Maintenance Data: For carpet tile to include in maintenance manuals specified in Division 1. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule. Training shall include instruction in the use of recommended bio-degradable cleaning products.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

B. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

C. Indoor Air Qualifications; Provide carpet and related carpet materials that meet or exceed the VOC limits established by the Carpet and Rug Institute (CRI) Green Label Test Program.

1.5 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with CRI 104, Section 5, "Storage and Handling."

1.6 PROJECT CONDITIONS

A. General: Comply with CRI 104, Section 6.1, "Site Conditions; Temperature and Humidity."

B. Environmental Limitations: Do not install carpet tile until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Do not install carpet tile over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tile, install carpet tile before installing these items.

1.7 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Carpet Tile Warranty: Written warranty, signed by carpet tile manufacturer agreeing to replace carpet tile that does not comply with requirements or that fails within specified warranty period. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.

Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and delamination.

1. Warranty Period: As indicated in manufacturers written literature.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to two (5) percent of amount installed for each type indicated.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Carpet Tile

1. Refer to Drawings.
    a. CPT-01 – Milliken, Revelation
    b. WO – Milliken, Obex.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided by or recommended by carpet tile manufacturer to level or raise area under carpet tiles to the level as required and indicated, according to the Construction Documents.

1. Gypsum-based products will not be Permitted!

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products 36 and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and that is recommended by carpet tile manufacturer.

1. VOC Limits: Provide adhesives that comply with the following limits for VOC content when tested according to ASTM D 5116:
    a. Total VOCs: 10.00 mg/sq. m x h.
    b. Formaldehyde: 0.05 mg/sq. m x h.
    c. 2-Ethyl-1-Hexanol: 3.00 mg/sq. m x h.
2. Carpet adhesives shall not exceed 50 g/L as per EQc4.1.

B. Primer (if needed): 9050 is an acrylic solution made to neutralize excess alkali that is also recommend as a primer coat to prevent over absorption of adhesive and to ensure a better bond. Formulated with an antimicrobial agent, it provides protection against bacteria, fungi, and mildew in the wet or dry state. Contains no solvent, alcohol, or other hazardous materials per OSHA 29 CFR 1910.1200. Non-photo chemically reactive per rule #102. Available in 4-gallon pails.

C. Leveling and Patching Compounds: Use a cementitious patching/leveling compound that meets or exceeds the required moisture level and pH requirements. Use of gypsum-based patching and/or leveling compounds which contain Portland or high alumina cement and meet or exceed the compressive strength of 3,000 psi are acceptable.

D. Transition Strips

E. Cove Base Accessories:
1. Angle Profile
2. Detail Profile
3. Quarter Round

PART 3 - EXECUTION

3.1 EXAMINATION

A. Substrates shall be smooth, structurally sound, permanently dry, clean and free of all foreign material such as dust, wax, solvents, paint, grease, oils, old adhesive residue, curing and hardening/ curing compounds, sealers and other foreign material that might prevent adhesive bond.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
2. Subfloor finishes comply with requirements specified in Division 3 Section "Cast-in-Place Concrete" for slabs receiving carpet tile.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 LAYOUT AND INSTALLATION

A. Start the tile installation as near to the center of the room as possible and position it to use the largest perimeter cut tile size.

B. Snap a chalk line parallel to one major wall bisecting the starting point. It may be necessary to offset the center chalk line to assure perimeter tiles will be at least half size.

C. Snap a second chalk line from the starting point at 90° to the first line. Use a 3-4-5, 6-8-10, or larger triangle depending on the room size. Meters or feet may be used to lay out the triangle in these proportions.

D. Install each full carton and complete an entire pallet before starting another pallet to minimize product variation. Each tile has directional arrows on the back. These arrows allow for one-directional or multi-directional installation. Some styles may be large scale or linear in design and require quarter turning. If you are unsure about whether or not your product requires a quarter turned installation, please contact 1.877.502.7429. Numbers within the arrows are for manufacturing purposes and are not related to installation.

E. Begin installation at the intersection of two chalk lines. Continue until you complete one quadrant. Proceed to an adjoining quadrant until all four quadrants are completed. Larger areas may require chalk lines bisecting the original four quadrants.

F. Install tiles using the pyramid technique. This gives you multiple alignment checks. If the edges do not align and the misalignment increases with progression of the installation, find and correct the source of the problem.

G. Carpet tiles come in various sizes. All Shaw tiles have directional arrows on the back of the tile. Slide tiles into position to prevent yarn from being trapped between the tiles. Trapped yarn will adversely affect the appearance of the installation and will cause alignment problems.

H. Tiles must fit snugly, but not be compressed. Press the entire surface of the tile to ensure adhesion. Check for fit by measuring the length of ten full tiles after installation. The measurement must not be less than, or exceed by more than 1/4 inch, the length of the tiles being multiplied by ten. For example: if 24" X 24" tiles are being installed, the measurement should be between 240 and 240 1/4 inches.

I. Measure and cut tiles from the back using a straight edge. Be sure the arrows are pointing in the correct direction.

J. Roll the entire installation with a 75 lb. or greater roller to assure the proper adhesion to the substrate.

3.3 MAINTENANCE

A. Post-installation Care
1. Place plywood over the carpet when heavy objects will be moved within 24 hours after installation.

B. Preventative Floor Care
1. Use protective chair mats under chairs with casters.
2. Use soil removal mats at exterior entrances.
3. Use absorbent mats in areas where moisture, oil and grease are present.

C. Routine Maintenance
1. Set a schedule depending on traffic and vacuum regularly.
2. Remove spots with spot removers as soon as they occur.
3. Use encapsulation agents periodically.
4. Clean with hot water extraction periodically.

END OF SECTION 09.6813

SECTION 098319 – SOUND-ABSORBING UNITS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general conditions of Contract, including General and Supplementary Conditions and Divisions-1 Specification sections apply to work of this section.

1.2 SUMMARY

A. Section Includes:

1. Acoustical wall panels and installation components.

B. Related Sections:

1. Section 09 20 00 (09200) – Plaster and Gypsum Board

2. Division 26 Sections - Electrical Work

C. Alternates

1. Prior Approval: Unless otherwise provided for in the Contract documents, proposed product substitutions may be submitted no later than TEN (10) working days prior to the date established for receipt of bids. Acceptability of a proposed substitution is contingent upon the Architect's review of the proposal for acceptability and approved products will be set forth by the Addenda. If included in a Bid are substitute products which have not been approved by Addenda, the specified products shall be provided without additional compensation.

2. Submittals which do not provide adequate data for the product evaluation will not be considered. The proposed substitution must meet all requirements of this section, including but not necessarily limited to, the following: Single source materials suppliers (if specified in Section 1.5); Panel design, size, composition, color, and finish; installation system component profiles and sizes; Compliance with the referenced standards.

1.3 REFERENCES

A. Test Methods:

1. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

2. ASTM E 84/CAN/ULC S102 Standard Test Method for Surface Burning Characteristics of Building Materials.

3. CAN/ULC S102 Standard Test Method for Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical data for each type of acoustical wall panel required.

B. Samples: Minimum 3-inch x 3-inch samples of specified acoustical wall substrate; minimum 4-inch-long samples of attachment method including trim and decorative accents.

C. Shop Drawings: Submit shop drawings showing how panels are to be laid out on the walls, details of trim members and width of panels. Width of panels and location of vertical seams are critical.

1.5 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide acoustical panel units and installation components by a single manufacturer.

B. Fire Performance Characteristics: Identify acoustical wall components with appropriate markings of applicable testing and inspecting organization.

1. Surface Burning Characteristics: As follows, tested per ASTM E 84,

a. Flame Spread: 25 or less

b. Smoke Developed: 200 or less

C. Coordination of Work: Coordinate acoustical wall work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical wall panels to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical wall panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical wall panels carefully to avoid chipping edges or damaged units in any way.

1.7 PROJECT CONDITIONS

A. Space Enclosure:

1. Soundsoak Fiberglass Panels: All wet work must be complete and dry prior to installation. Installation shall be carried out where the temperature is between 40 degrees F and 120 degrees F. These temperature conditions must be maintained throughout the life of the warranty.

1.8 WARRANTY

A. Acoustical Wall Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace acoustical panels that fail within the warranty period. Failures include, but are not limited to:

1. Acoustical Wall Panels: Manufacturer's defects.

B. Warranty Period:

1. Acoustical wall panels: One (1) year from date of substantial completion.

C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.9 MAINTENANCE

A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.

1. Acoustical Wall Panels: Furnish quantity of full-size units equal to 5.0 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acoustic Wall Panels: AWP-01 Art Concepts, Akuwood

B. Or equals: Kinetics Noise Control, Inc., Decoustics

2.2 ACOUSTIC WALL PANELS

A. Acoustical Wall Panels: Type **AWP-01**:

1. Manufacturer: Artizin Acoustical Solutions, 3402 W Miller Road, Garland, TX 75041
2. Composition: 18mm Artfelt, 60% recycled Polyester fiber, 40% virgin Fiber
3. Style: Duo-Cut, Dot& Dash, 2 color, as indicated on drawings
4. Sizes: 47.5" x 95" or as indicated on drawings.
5. Noise Reduction Coefficient (NRC): .60
6. Flame Spread: ASTM E84 ISAN -Class A rating.
7. Installation: Glued

A. Acoustical Ceiling Panels: Type ACT-01:

1. Manufacturer: Akuwood Panel, 2803 Philadelphia Pike, Suite B PMB 7149, Claymont, DE 19703
2. Composition: PET Polyesterbacking and MDF slats with Wood Veneer
3. Thickness: 1 inch
4. Sizes: 48” x 96” or as indicated on drawings.
5. Noise Reduction Coefficient (NRC): .85
6. Flame Spread: ASTM E84 ISAN -Class A rating.
7. Installation, Glued and screwed.

B. Acoustical Wall Panel Accessories:

1. Adhesive – As recommended by the manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer’s printed recommendations.

3.2 PREPARATION

A. Measure each wall area and establish layout of acoustical units to balance border widths at opposite edges of each wall. Coordinate panel layout with mechanical and electrical fixtures.

3.3 INSTALLATION

A. Install wall panels by attaching the panels to an existing wall per the manufacturer’s instructions, LA-297301, and in accordance with the authorities having jurisdiction.
B. For installation instructions with internal H spline, refer to installation instructions for standard Soundsoak, LA-295818.

3.4 ADJUSTING AND CLEANING

A. Replace damaged and broken panels.
B. Routine maintenance of wall panels should consist of frequent vacuuming to minimize dirt accumulation. Work in with a damp sponge and vacuum to remove residue.

END OF SECTION 09.8319

SECTION 09.9100 – PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes surface preparation and the application of paint systems.

B. Paint and finish all new and existing, exterior and interior exposed surfaces throughout the building as indicated on the Drawings, as listed on the Painting Schedule in Part 3 of this Section, as specified herein, and as needed for a complete and proper installation.

C. Work not included:
1. Unless otherwise indicated, painting is not required on surfaces in concealed areas and inaccessible areas such as furred spaces and the area above suspended ceilings;
2. Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze, and similar finished materials will not require painting under this Section unless otherwise indicated;
3. Do not paint moving parts of operating units; mechanical or electrical parts such as valve operators, linkages, sensing devices, and motor shafts, unless otherwise indicated;
4. Do not paint over required labels or equipment identification, performance rating, name, or nomenclature plates;
5. Metal surfaces of pre-finished galvalume and galvanized steel, metal roofing, metal fascia and trims, metal siding, metal ceiling, all galvanized bollards, all exposed zinc coated steel plates, anchors, and fasteners, etc. that have galvalume or galvanizing will not require painting under this Section unless otherwise indicated.

D. Definitions: "Paint" or “Epoxy” as used herein, means coating systems materials including primers, emulsions, epoxy enamels, sealers, fillers, and other applied materials whether used as prime, intermediate, or finish coats.

E. Related work: Priming or priming and finishing of certain surfaces may be specified to be factory-performed or installer-performed under pertinent other Sections.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For each type of topcoat product indicated.

C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8 inches square.
2. Step coats on samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.

E. Color selection and samples:

1. Colors will be selected by the Architect from one or more of the specified manufacturers paint lines. Submit samples on rigid cardboard 8-1/2 inches by 11 inches in size with the Architects scheduled colors and glosses applied, for approval before starting work. Sample panels shall be resubmitted to the Architect until final approval is granted. Finished work shall match approved samples;
2. The Architect may select, allocate, and vary colors on different surfaces throughout the Work, subject to the following:
    a. Exterior work: A maximum of four different colors will be used, with variations for trim, doors, miscellaneous work, and metal work;
    b. Interior work: A maximum of eight different pigmented colors will be used, with variations for trim, wall surfaces and wainscots;
    c. Dark tones: A maximum of four dark tones will be used as accent colors for the interior;

1.4 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

C. Protection:
1. Remove or protect during painting, all finish hardware, accessories, fixtures, plates, lighting fixtures, and similar items installed prior to painting and not required to be painted. If removed, carefully replace and adjust on completion of painting;
2. Furnish and lay drop cloths in all areas where painter's finish work is being done, to protect floors and all other adjacent work and materials from defacement. Remove all temporary protections and coverings from the work and repair or replace finishes;
3. Any damage resulting from neglect of the above requirements shall be repaired at the Contractor's expense to the complete satisfaction of the Architect.

D. Environmental Conditions:
1. No exterior painting shall be done in rainy, damp or frosty weather, or until surface is thoroughly dry. No interior painting or finishing shall be permitted until the building has reached a temperature and humidity level recommended by the manufacturer of the paint products being applied;
2. Maintain temperature of rooms at 70 degrees F or higher where varnish, lacquer or enamel is being applied and at 50 degrees F or higher during other painting and finishing. Exterior painting shall be done only when air temperature is 40 degrees F or higher and only in dry weather;
3. Apply material under adequate illumination and ventilation;
4. In the event excessive moisture is present, the General Contractor shall provide the necessary ventilation to establish appropriate conditions. Should the surface be too dry for the product application, the Painting Contractor shall provide the necessary methods to establish the appropriate conditions.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 10 percent, but not less than 1 gallon of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: All paint materials and their related products specified herein are based on products of first grade and top line manufactured products, of Sherwin-Williams Company. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Benjamin Moore & Co.
2. PPG Architectural Finishes, Inc.

B. Semi-transparent colored stain for architectural millwork items shall be by Minwax, or alternatives of the quality necessary to meet the specifications, offering a range of colored semi-transparent colored stain selections, and as approved by the Architect.

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work. Correct conditions detrimental to timely and proper completion of the Work prior to proceeding.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   1. Concrete: 12 percent.
   2. Masonry (Clay and CMU): 12 percent.
   3. Wood: 15 percent.
   4. Plaster: 12 percent.
   5. Gypsum Board: 12 percent.
   6. Plaster: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
   1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

E. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
   1. Notify the Architect about anticipated problems using the materials specified over substrates primed by others.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
   2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
   3. Mask surfaces and construction adjacent to paint application areas to prevent paint from spilling or spattering other areas.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

   1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

2. Cementitious Materials: Prepare concrete and masonry surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
    a. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.
    b. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.
3. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.
    a. Blast steel surfaces clean as recommended by paint system manufacturer and according to requirements of SSPC-SP 10.
    b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
    c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.

D. Spackle all wall cracks, voids and similar imperfections, in drywall and plaster.

E. Clean all metal free from dust and grease and carefully wire brush to remove all rust or scale. Sand badly rusted spots until metal is clean. Sheet metal, steel and cast wrought iron with priming coat applied, shall be cleaned of debris, and if necessary, the marred surfaces shall be primed before applying the first coat. Clean and lightly sand prefinished metals, such as rooftop mechanical equipment thoroughly before applying the first coat.

F. Galvanized materials shall receive a prime coating of an approved galvanized primer, such as zinc dust. Apply zinc chromate or an equivalent primer as recommended by the paint and aluminum alloy manufacturer to aluminum work, which is specified or noted as being painted.

G. Thoroughly clean, sand, and wipe woodwork to remove all surface dirt.

1. Fill nail holes or similar imperfections smooth with putty after prime coat has become dry and hard. On natural finish wood, the nail hole compound shall be pigmented to match the face veneer.
2. When transparent finish is required, backprime with spar varnish.

H. Prepare surfaces of masonry to be painted in strict conformance with the recommendations of the paint manufacturer. Insure that all loose material and material that will dust or dislodge

when lightly abraded has been completely removed from masonry surfaces before the application of paint materials.

I. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
   1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
   2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
   3. Use only thinners approved by paint manufacturer and only within recommended limits.

J. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

   1. Apply materials with roller or brush, except that spraying will be permitted for items such as mechanical equipment, grilles, or similar items. Mask off adjoining areas not receiving a spray finish against overspray.
   2. Paint surfaces behind movable equipment and furniture items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture items with prime coat only.
   3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
   4. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
   5. Provide finish coats that are compatible with primers used.
   6. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
   7. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
   8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
   9. Sand lightly between each succeeding enamel or varnish coat.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Allow exterior paints and finishes to dry at least 48 hours between coats. Allow interior paints to dry at least 24 hours between coats. Allow enamels, lacquers and varnishes to dry at least forty-eight hours between coats. Sand lightly between coats with No. 00 sandpaper and dust well before succeeding coat is applied. Allow additional drying time if conditions warrant, to assure that all coats are perfectly dry before applying succeeding coats.

F. Review with the Architect prior to application the surface texture of all painting and finishing. Submit samples, if requested, for approval.

G. All materials throughout shall receive the manufacturer's recommended primer before the finish coats are applied. Touch-up shop applied prime coats, which have been damaged, and touch-up bare areas prior to start of finish coats application.

H. Miscellaneous surfaces and procedures:

1. Exposed mechanical items:
    a. Finish electric panels, access doors, conduits, pipes, ducts, grilles, registers, vents, hangers, and items of similar nature to match adjacent wall and ceiling surfaces, or as directed;
    b. Paint visible duct surfaces behind vents, registers, and grilles flat black;
    c. The painting of mechanical piping and equipment shall include the painting of non-ferrous piping and valve and trap bodies in finished spaces;
    d. Paint exterior louvers, dampers, and grilles in colors as selected by the Architect;
2. Exposed electrical items: Paint all exterior electrical items in colors as selected by the Architect;
3. Paint hollow metal and miscellaneous metal installations in unfinished spaces;
4. Paint metal doors in unfinished spaces.

I. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer. Use application rate to achieve finished dry film thickness (DFT) as indicated for each coat.

J. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.

K. Mechanical items to be painted include, but are not limited to, the following:
1. Cabinet heater enclosures.
2. Piping, pipe hangers, and supports.
3. Heat exchangers.
4. Tanks.
5. Ductwork.
6. Insulation.
7. Supports.
8. Motors and mechanical equipment.
9. Accessory items.

L. Electrical items to be painted include, but are not limited to, the following:
1. Conduit and fittings.
2. Switchgear.
3. Panelboards.

M. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
1. Provide a smooth, uniform finish, appearance, and coverage. Spotting, laps, roller marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
2. Spray application will not be permitted unless combined with back rolling or squeegeeing. Do not thin filler. Apply sufficient material to allow back rolling or squeegeeing to fill surface.
3. Where two filler coats are scheduled, allow first coat to fully dry before application of second. Back roll or squeegee both coats.
4. Do not use squeegee for scored unit masonry; backroll in manner that prevents buildup of block filler in score joints.
5. Extend block filler coats the full extent of exposed surfaces. Protect adjacent surfaces.

N. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been field prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

O. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

P. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.
   1. Provide satin finish for final coats.

Q. Electrostatic Painting: Connect target substrate to be painted to ground to create magnetic surface that will attract negatively charged paint particles. Apply paint to prepare surfaces to produce uniform, regular coating layers and a smooth, even finish.

R. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 FINISH

A. Finished surfaces shall be uniform in finish and color and free of brush marks, sagging, corduroy and other imperfections. Should any coat be judged unsatisfactory, sandpaper or otherwise clean off this coat and apply another. If the undercoating is disturbed, complete refinishing will be required. Where necessary for proper coverage, one additional coat shall be applied by the painter without any additional cost to the Owner.

B. Edges of paint or finish adjoining other materials or colors shall be sharp and clean without overlapping.

C. Should workmanship be found defective, proper preparatory work shall be done and additional coats applied as necessary to give finish in accordance with specified requirements.

3.6 PAINTING SCHEDULE

A. The following paint schedule shall generally cover the type of paint required for the project based on Sherwin Williams Company. Verify finishes with finish schedule and Architect prior to application. Verify first coat in accordance with manufacturer's recommendation for previously painted surfaces.

INTERIOR PAINT SCHEDULE

Masonry and Concrete – Ceilings and Soffits - Flat Finish
Primer: Loxon Concrete and Masonry Primer
2 finish coats: ProMar 200 Zero VOC flat

Masonry and Concrete – Eggshell Finish
Primer: Loxon Concrete and Masonry Primer
2 finish coats: ProMar 200 Zero VOC eggshell

CMU – Eggshell Finish
Filler: ProIndustrial HD Block Filler
2 finish coats: ProMar 200 Zero VOC eggshell

CMU – Pre-Catalyzed EPOXY (eggshell finish or semi-gloss finish)
Light Commercial, Dry Laboratories and Rest Rooms
Filler: ProIndustrial HD Block Filler
2 finish coats: ProIndustrial Pre-Catalyzed Water-Based Epoxy semi-gloss

Gypsum – Ceilings and Soffits- Flat Finish
Primer: ProMar Ceiling Paint flat
Finish coat: ProMar Ceiling Paint flat

Gypsum – Eggshell Finish
Primer: ProMar 200 Zero Primer
2 finish coats: ProMar 200 Zero VOC eggshell

Gypsum – Semi-Gloss Finish
Primer: ProMar 200 Zero VOC Primer
2 finish coats: ProMar 200 Zero VOC semi-gloss

Gypsum – Pre-Catalyzed EPOXY
Light commercial, Dry Laboratories and Rest Rooms
Primer: ProMar 200 Zero VOC Primer
2 finish coats: ProIndustrial Pre-Catalyzed Water-Based Epoxy eggshell

Wood- Painted – Semi-Gloss Finish

Primer: ProMar 200 Zero VOC Primer
2 finish coats: Solo 100% Acrylic Latex, semi-gloss

Ferrous Metal and Non-Ferrous Metal – Doors, Frames, non-traffic Stair components and miscellaneous Metals, including elevator frames and doors

Primer: ProIndustrial Pro-Cryl Universal Primer
2 finish coats: ProIndustrial Pre-Catalyzed Water-Based Epoxy, semi-gloss
semi gloss

Concrete Floors – (Pigmented or Clear)

2 finish coats: ArmorSeal 8100 WB Epoxy coating,

Exposed Ceilings:

Primer (Ferrous and Non-Ferrous Metal): ProIndustrial Pro-cryl Universal Primer
2 coats: Low VOC Waterborne Acrylic Dryfall, **Flat** B42-W00081
OR Low VOC Waterborne Acrylic Dryfall, **Eg-shell** B42-W00082

EXTERIOR SCHEDULE

Exterior AES

Primer: MacroPoxy 646 Epoxy
2 finish coats: Hi Solids Polyurethane, semi-gloss

Ferrous Metal and Non-Ferrous Metal **Doors, Frames, Stair Components and Miscellaneous Metals Includes, but is not limited to, Elevator Frames and Doors.**

Primer: ProIndustrial Pro-Cryl Universal Primer
2 finish coats: ProIndustrial WB Alkyd Urethane Enamel, B53 series, semi-gloss

END OF SECTION 09.9100

SECTION 10.1100 - VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Markerboards.
2. Tackboards.
3. Combination Boards.
4. Floor-to-Ceiling Visual Display Assemblies.
5. Corridor Bulletin Boards to replace existing.
6. Display rails.

B. Related Requirements:
1. Section 061000 "Rough Carpentry" for proper blocking and other anchorages required to sustain visual display units.
2. Section 097723 "Fabric-Wrapped Panels" for tackable, fabric-covered panels mounted on walls.
3. Section 099123 "Interior Painting" for the use of primers and sealants when visual display assemblies are adhered to walls with adhesive.
4. Section 101200 "Display Cases" for bulletin boards and display cases.
5. Section 101146 "Visual Display Fabrics" for visual display wall coverings intended for use with dry-erase markers.

1.3 REFERENCES

A. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

B. ASTM C 208 - Standard Specification for Cellulosic Fiber Insulating Board.

C. ASTM E 84 - Standard Test Method for Surface Burning Characteristics for Building Materials.

D. Federal Specifications (FS) CCC-W-408D - Wall Covering, Vinyl Coated.

E. Porcelain Enamel Institute PEI-1002 - Manual and Performance Specifications for Porcelain Enamel Writing Surfaces.

F. ANSI A 135.1 - Hardboard.

G. ANSI A 208.1 - Particleboard.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Include manufacturer's technical data sheets, listing construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.

B. Shop Drawings:

1. Include dimensioned plans, elevations, details, and attachment(s) to other work. Show anchors and accessories.
2. Show locations of panel joints. Show locations of field-assembled joints for factory-fabricated units too large to ship in one piece.
3. Include sections of typical trim members.

C. Samples for Initial Selection: For each type of visual display unit indicated, for units with factory-applied color finishes, and as follows:

1. Samples of facing, core, and backing for each visual display panel type, indicating color and texture.
2. Swatches of tackable material indicating color and texture, including natural and colored cork, vinyl, and fabric.

D. Samples for Verification:

1. Visual Display Panel: Not less than 13 by 17 inches (330 by 431 mm), with facing, core, and backing indicated for final Work. Include one panel for each type, color, and texture required.
2. Trim: 6-inch- (150-mm-) long sections of each trim profile.
3. Display Rail: 6-inch- (150-mm-) long section of each type.
4. Accessories: Full-size Sample of each type of accessory.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: Provide manufacturer's standard care and cleaning instructions, installation guide, and a clean copy of the final approved submittals for owner's records.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

B. Ship products upright in a manner providing proper protection.

C. Provide factory-installed protective covering for markerboards. Do not remove until after installation

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weather-tight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify actual dimensions of construction relevant to visual display units before fabrication.

1.8 WARRANTY

A. Markerboards: Provide manufacturer's life of the building warranty providing coverage against loss of original writing or erasing capabilities, crazing, cracking, flaking, and staining of the porcelain enamel writing surface.

B. Tackboards: Provide manufacturer's five-year warranty providing coverage against manufacturing defects in material and workmanship for all tackable surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of visual display unit from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified independent testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: Less than 450.

2.3 MARKERBOARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide AJW Architectural Products; Markerboards or comparable product by one of the following:
   1. Claridge

2. Moore Co.
3. Egan Visual Inc.
4. Aarco Products

B. Substitutions: Under provisions of Division 01.

C. Markerboard Assembly:

1. Height: 4’-0”
2. Width: 10’-0”
3. Mounting Method: Direct to wall.

D. Markerboard Panel: Balanced, high-pressure laminated, porcelain enamel-faced panels, of three ply construction consisting of face sheet, core material, and backing.

1. Porcelain Face Sheet: Enameling grade cold-rolled steel, specially processed for temperatures used in coating porcelain on steel. Coat faces and exposed edges with three coat process consisting of primer, ground coat, and color cover coat.
2. Core Material: 1/2 inch (13 mm) thick particleboard, ANSI 208.1, Grade 1-M-1.
3. Backing Sheet: Manufacturer's standard aluminum foil sheet.
4. Laminating Adhesive: Manufacturer's standard moisture resistant thermoplastic adhesive.

E. Fabricated from not less than 0.062-inch- (1.57-mm-) thick, extruded aluminum; 3/4 inch (19 mm) Flat Trim.
1. Aluminum Finish: Clear anodized finish.

F. Joints: Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, as indicated on approved Shop Drawings.

G. Marker Tray: Continuous.

1. Box Type: Extruded aluminum with slanted front, grooved tray, and cast-aluminum end closures.
2. Aluminum Finish: Match finish of visual display assembly trim.

H. Location:
1. Provide as indicated on Equipment plans

2.4 DISPLAY RAILS

A. Basis-of-Design Product: Subject to compliance with requirements, provide AJW Architectural Products; Display Rail or a comparable product by one of the following:

1. Claridge
2. Moore Co.
3. Egan Visual Inc.

B. Substitutions: Under provisions of Division 01.

C. Aluminum Display Rail: Extruded-aluminum display rail with tackable insert designed to hold accessories.

1. Profile: 2 inch (50 mm)
2. Tackable Insert: 1/4 inch (6.4 mm) Natural Cork

D. Map Rail: Provide the following accessories:

1. Display Rail: Continuous and integral with map rail; fabricated from cork approximately 2 inches wide.
2. End Stops: Located at each end of map rail.
3. Map Hooks/Paper Holder and Clips: Two map hooks with flexible metal clips for every 10 feet of map rail or fraction thereof.

2.9 MATERIALS

a. Porcelain-Enamel Face Sheet: PEI-1002, with face sheet manufacturer's standard three-coat process.

b. Hardboard: ANSI A135.4, tempered.

c. Particleboard: ANSI A208.1, Grade 1-M-1 that complies with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

d. Fiberboard: ASTM C 208 cellulosic fiber insulating board.

e. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063.

f. Adhesives for Field Application: Mildew-resistant, nonstaining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by visual display unit manufacturer.

i. Adhesives shall have a VOC content of 50 g/L or less.
ii. Adhesives shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

g. Primer/Sealer: Mildew-resistant primer/sealer complying with requirements in Section 099100 "Interior Painting" and recommended in writing by visual display unit manufacturer for intended substrate.

2.10 GENERAL FINISH REQUIREMENTS

a. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

b. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

c. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.11 ALUMINUM FINISHES

A. Clear Anodized Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine all work areas and verify that all applicable measurements, structural supports, backing, and environmental conditions are in accordance with manufacturer's prerequisites for installation.

B. Examine walls and partitions for proper preparation and backing for visual display units.

C. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.

D. Proceed with installation only after the above criteria is met.

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.

C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.

D. Prepare recesses for sliding visual display units as required by type and size of unit.

3.03 INSTALLATION

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

B. Field-Assembled Visual Display Board Assemblies: Coordinate field-assembled units with grounds, trim, and accessories indicated. Join parts with a neat, precision fit.

C. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, as indicated on approved Shop Drawings.

D. Where size of visual display board assemblies or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.

E. Factory-Fabricated Visual Display Board Assemblies: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches (400 mm) o.c. Secure tops and bottoms of boards to walls.

F. Mounting Height for Grades K through Fifth 26 inches (610 mm) above finished floor to top of marker tray.

G. Display Rails: Install rails at mounting heights indicated on Drawings, or if not indicated, at height indicated below. Attach to wall surface with fasteners at not more than 16 inches (400 mm) o.c.

H. Floor-to-Ceiling Tackboard Panels: Attach panels to wall surface in accordance with Forbo’s installation guidelines.

3.4 CLEANING AND PROTECTION

h. Remove temporary protective coatings.

i. Clean visual display units according to manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.

j. Touch up factory-applied finishes to restore damaged or soiled areas.

k. Cover and protect visual display units after installation and cleaning.

3.5 FINAL CLEANUP

l. Legally dispose of all packaging and construction debris.

END OF SECTION 10.1100

SECTION 10.1400 – INTERIOR TACTILE SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section

1.1 SECTION INCLUDES

A. Interior panel signs.

1.3 REFERENCES

A. Department of Justice - Title II regulation (28CFR Part 35) and Title III regulation (28 CFR Part 36).
B. ICC/ANSI A117.1 2003 Standard on Accessible and Useable Buildings and facilities or applicable standards of authorities having jurisdiction.
C. ADA Accessibility Guidelines for Buildings and Facilities – ADAAG.

1.4 SUBMITTALS

A. Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
B. Product Data: Manufacturers descriptive literature for each sign product specified including installation instructions.
C. Shop Drawings: Elevation and plan drawings for each sign type showing: material, thickness, color, design, shape, size, edge, corner; text, Braille and/or pictogram layout, and components.
D. Sample: Provide a sample of each sign product specified to verify compliance with the drawings and specifications.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in protective packaging until ready for installation.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Basis-of Design Product: Subject to compliance with requirements, provide the following or a comparable product by one of the available manufactureres indicated:

1. Provide signs based on ASE, Inc. Product Series: IN 500 – Inlayed Acrylic: Architectural Signs & Engraving, (ASE, Inc.)

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be considered to be incorporated into the Work include, but are not limited to, the following:

1. Inpro Corp
2. Identity Group
3. Fast Signs
4. iSign

C. Contractor must submit any product not specified a minimum ten (10) days before the bid date to Architect in order for product to be considered for approval. The Architect will notify Contractor in writing of decision to accept or reject request.

D. Substitutions: Products proposed as equal to the products specified in this Section shall be submitted in accordance with Bidding Requirements and Division 1 provisions.

1. Include a list of three (3) projects of similar type and extent, located within a one hundred mile radius from the location of the project. In addition, the three projects must be at least five (5) years old and be available for inspection by the Architect, Owner or Owner's Representative.

2. Equivalency of performance criteria, warranty terms, submittal procedures, and contractual terms will constitute the basis of acceptance.

3. The Owner's decision regarding substitutions will be considered final. Unauthorized substitutions will be rejected.

2.2 MATERIALS

A. Acrylic sheet: Cast methyl methacrylate monomer plastic sheet
   a. ASTM D790 minimum flexural strength – 16,000 psi.
   b. Maximum continuous temperature – 180 – 200 degrees F.
   c. Matte non-glare finish.

B. Single ply modified acrylic plate.
   d. UV stable.
   e. Matte non-glare finish.

C. Lexan: Polycarbonate resin thermoplastic

2.3 FABRICATION

A. Signs shall comply with the regulations and standards referenced in 10440.1.2.
B. Acrylic sheet shall be CNC cut to specifications with square or radius corners, and/or custom shapes.

C. Identically sized1/32 inch modified acrylic plate shall be adhered to theacrylic plate with a high bond chemical adhesive and the text and/or symbols shall be CNC cut to specifications. Text and/or symbols shall be removed from the sign face.
D. Corresponding text and/or symbols shall be CNC cut from 1/16 inch modified acrylic embedded 1/32 inch and chemically welded to the acrylic plate.
E. Domed grade 2 Braille shall be embedded in the surface.
F. Comply with requirements indicated for material, thickness, color, finish, design, shape, size and details of construction.
G. Text and symbols shall contrast with their background, i.e. light characters on a dark background or dark characters on a light background.

2.4 SIGNS

A. Provide signs in accordance with Section 10440.3.4 (See sign schedule and drawings.)
B. Inlayed acrylic signs:
    a. Text and graphics color to be selected by Architect from manufacturers standard colors.
    b. Background color to be custom color as selected by Architect
    c. Sign size: Refer to sign schedule and/or drawings.
    d. Text size: [5/8 inch high (min)][Size], raised 1/32 inch, with grade 2 Braille below text.
    e. Graphics: International symbols for indicated information.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that substrate has been properly prepared and that surfaces are cured.
B. Notify Architect of unsatisfactory preparation before proceeding.

3.2 INSTALLATION

A. Locate signs where indicated or directed by Architect. Install level and plumb in accordance with manufacturers recommendations.
B. Locate in accordance with Section 10440.1.2.
C. Wall Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply

1. Concealed screw mounting: Mount signs by inserting threaded studs into tapped lugs on back of signs. Set in a predrilled holes filled with quick-setting cement.

3.3 PROTECTION

Protect installed products until project completion. Clean signs according to manufacturers instruction.

3.4 SCHEDULES

A. Room identification signage: Provide room identification signs for all rooms listed on the room finish schedules except for the following:

1. Vestibule
2. Corridors
3. Passage

B. Directional Signage: Whether indicated or not, provide directional signage which indicates the route to the nearest like accessible element at the following locations:

1. Inaccessible building entrances
2. Inaccessible public toilets
3. Elevators not serving an accessible route
4. Maximum load occupancy Signage: Provide at all assembly space.

END OF SECTION 10.1400

SECTION 10.1416 - PLAQUES AND SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Exterior Building Letters
2. Interior Building Plaque

1.3 SUBMITTALS

A. Comply with pertinent provisions of Division 1 Section “Submittals.”

B. Product data:

1. Materials list of items proposed to be provided under this Section;
2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements;
3. Manufacturer's data clearly defining the required support and other details of installation to enable proper interface with the work of other trades;
4. Manufacturer's recommended installation procedures.

C. Shop Drawings:

1. Complete full size Shop Drawings of the graphic layout of the work which, when approved by the Architect, will become the basis for accepting or rejecting the actual products. Shop Drawings for plaques shall be submitted in at least three stages (as conceptual layouts, preliminary designs, and final fabrication drawings) and shall be revised and resubmitted at each stage until the Architect's approval is secured for that particular stage of submission. The initial conceptual stage submission shall present at least three alternate concepts for each plaque from which the final design may evolve;

D. Samples: Color samples of manufacturers' full ranges of standard colors.

1.4 QUALITY ASSURANCE

A. Regulatory requirements: All signage shall be in accordance with all applicable government regulations and requirements.

PART 2 – PRODUCTS

2.1 INTERIOR BUILDING PLAQUE

A. Design is based on the use of standard products manufactured by A.R.K. Ramos Architectural Signage Systems, Oklahoma City, Oklahoma. Provide products of specified manufacturer, or equal products by Matthews Architectural Division, Pittsburgh, PA; or Metal Arts, Inc, Division of L&H Manufacturing Co; or alternative products of the quality necessary to meet the specifications.

B. Provide interior cast plaque as follows:
1. 30 inches by 42 inches cast aluminum plaques.
2. Letter style as selected by the Architect from manufactures full range of available fonts. Allow for the use of 700 letters on the plaque.
3. Border style: "504."
4. Background texture: matte.
5. Plaque finish: Satin aluminum raised areas, with gun metal gray background.
6. Mounting method: concealed mounting for masonry.
7. Location: Where indicated on the Drawings or as directed by the Architect.

B. Design and layout will be provided by the Architect from which shop drawings shall be developed. Do not fabricate plaque until final shop drawing approval has been achieved.

2.2 EXTERIOR BACK LIT LETTERS

A. Cast Characters: Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:
1. Character Material: Cast aluminum.
2. Character Height: As indicated on Drawings.
3. Finishes:
   a. Integral Aluminum Finish: powder coated color as selected by architect.
4. Basis of Design: Cast Aluminum Letters in natural brushed finish by Impact Signs, Inc.

B. Fabricated Channel Characters: Metal face and side returns formed free from warp and distortion; with uniform faces, sharp corners, and precisely formed lines and profiles; internally braced for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners; and as follows.
1. Illuminated Characters: Backlighted LED lighting, including transformers, insulators, and other accessories for operability, with provision for servicing and concealing connections to building electrical system. Use tight or sealed joint construction to prevent unintentional light leakage. Space lamps apart from each other and away from character surfaces as needed to illuminate evenly.
   a. Power: As indicated on electrical Drawings.
2. Character Material: Sheet or plate Stainless Steel.
3. Character Height: As indicated on Drawings.
4. Character Depth: 1 inch.
5. Finishes:
   a. As selected by architect from manufacturers full range of colors

6. Mounting: Concealed, painted stainless steel back bar or bracket assembly.
   a. Hold characters at manufacturer's recommended distance from wall surface.
7. Basis of Design: LED Halo Lit Fabricated Metal Channel Letters by Impact Signs, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions where work of this Section will be performed. Correct unsatisfactory conditions prior to proceeding.

3.2 INSTALLATION

A. Coordinate with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. Install the work of this Section in strict accordance with the manufacturers' recommendations, using only the approved mounting materials, and anchoring all components firmly into position, level and plumb, using approved shop drawings for installation layout.

END OF SECTION 10.1416

SECTION 10.1419 - DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Cutout dimensional characters.

1.3 COORDINATION

A. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.4 SUBMITTALS

A. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.

B. Manufacturer's/fabricator's installation instructions shall be provided along with product data.

C. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).

D. Product Data: For each type of product.

E. Shop Drawings: For signs.

   1. Include fabrication and installation details and attachments to other work.
   2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
   3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.

F. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

   1. Include representative Samples of available typestyles and graphic symbols.

G. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Dimensional Characters: Full-size Sample of dimensional character.
2. Exposed Accessories: Full-size Sample of each accessory type.
3. Full-size Samples, if approved, will be returned to Contractor for use in the Project.

H. Product Schedule: For dimensional letter signs. Use same designations indicated on Drawings or specified.

I. Delegated-Design Submittal: For signs indicated in "Performance Requirements" Article.

1. Include structural analysis calculations for signs indicated to comply with design loads; signed and sealed by the qualified professional engineer, licensed in the State of New York, responsible for their preparation.

J. Qualification Data: For Installer and manufacturer, minimum 5 years' experience with similar projects and materials.

K. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: an entity that employs installers and supervisors who are trained and approved by manufacturer/fabricator

1.7 FIELD CONDITIONS

A. Field Measurements: Verify locations of electrical service embedded in permanent construction by other installers by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, licensed and registered to practice in the State of PA, to design sign structure and anchorage of dimensional character according to structural performance requirements.

B. Structural Performance: Signs and supporting elements shall withstand the effects of gravity and other loads within limits and under conditions indicated.

2.2 DIMENSIONAL CHARACTERS

A. Cutout Characters See Elevation 4/A5.11 Characters with uniform faces; square-cut, smooth**,** eased edges; precisely formed lines and profiles; and as follows:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. Fast Signs
   b. Poyaint Signs
   c. Approved equivalent.

2. Character Material: Walnut Wood.
3. Character Height: As indicated on Drawings.
4. Thickness: 2”
5. Finishes:
   a. Wood stained to match project English Walnut control sample.

6. Mounting: Direct concealed mount.
7. Typeface: Century Gothic.

2.3 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.

2.4 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.

2. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
3. Internally brace dimensional characters for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

2.5 GENERAL FINISH REQUIREMENTS

A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.

b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect them from damage until acceptance by the Director’s Representative.

END OF SECTION 10.1419

SECTION 10.1453 - POST MOUNTED SIGNS

PART 1 GENERAL

1.01 SECTION DESCRIPTION

A. This work is the furnishing and installation Post Mount Signs Type A, Type B, and Type C as identified in the Pennsylvania Department of Transportation Publication 408 Specifications, latest edition; Publication 72 Standards for Roadway Construction, latest edition; and Publication 111 Traffic Control – Pavement Markings and Signing Standards.

1. Post Mounted Signs Type A - This work is furnishing, and installation of fabricated aluminum signs of the type indicated on steel S or W beam posts and breakaway system per PennDOT Pub 408, Section 930.

2. Post Mounted Signs Type B - This work is furnishing and installation of flat sheet signs on breakaway steel posts per PennDOT Pub 408, Section 931.

3. Post Mounted Signs Type C - This work is the furnishing and installation of flat sheet signs on wood posts per PennDOT Pub 408, Section 932.

PART 2 PRODUCTS

2.01 MATERIAL

A. Materials used shall be in accordance with Sections 1103.02, 1103.03, 1103.04, 1103.07, 1103.08, 1103.09, 1103.11, and 1105.02 of PennDOT Publication 408 related to applicable Post Mounted Sign Type.

PART 3 EXECUTION

3.01 CONSTRUCTION

A. Installation as shown in Publication 111 Traffic Control – Pavement Markings and Signing Standards and described in Publication 408 Specifications.

1. Type A - Erect posts plumb using a method that does not twist, bend or otherwise deform the posts. Before erection, correct twisted, bent, or deformed posts. Erect signs by a method that does not twist, bend, or otherwise deform the signs. Level, correctly align, and then center signs on the posts and properly fasten. Repair or replace damaged posts and signs. Fasten the signs to the posts with the necessary hardware as detailed in TC-8700 Series.

2. Type B - Drive anchors into undisturbed earth with anchor top a maximum of 4 inches above lower slope side. Drill concrete if posts are to be located in concrete areas. Drive square anchor into undisturbed earth and place concrete if square steel posts are used in concrete. Complete installation after concrete is cured a minimum of 72 hours. Fasten STOP and YIELD signs, and other signs if indicated, to posts with anti-theft hardware. Permanently scribe 1-inch numerals on back of sign indicating the month and year of installation. Remove and dispose of existing signs or sign installations, only when indicated or as directed by Owner.

3. Type C - Excavate for the post foundation. Place the post, with shim plates and bars attached, in the sleeve in the excavated foundation. Carefully set the sleeve, using the

temporary framing to ensure proper location. Place foundation concrete, as specified in the applicable parts of Section 1001.3, against undisturbed earth. Finish the foundation tops flush and in the same plane as the adjacent ground, except trowel the concrete surface and shape to prevent water standing against the posts. Drill or form the hole if posts are to be located in concrete such as divisors or islands. Limit field cutting of posts to a minimum. Field treat the cut area with the original post preservative. Where multiple sign assemblies on the same installation require larger posts than shown on the Standard Drawings, refer to the Standard Drawings for post mounted signs, Type E. Permanently scribe 1-inch numerals on back of sign indicating the month and year of installation

B. Location

The indicated location of sign installations is approximate with the exact location established at the site. Mark longitudinal and lateral location by stake or paint marks with an identifying symbol. Install posts and signage at required roadway setback and height clearance per PennDOT Pub 111, TC-8700 Series.

END OF SECTION

SECTION 10.2113 – TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Solid plastic toilet compartments including the following:

1. Floor mounted overhead-braced toilet compartments.
2. Privacy screens.

1.2 RELATED SECTIONS

A. Section 05.5000 - Metal Fabrications.

B. Section 06.1000 - Rough Carpentry.

1.3 REFERENCES

A. ASTM A 666 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

B. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

C. National Fire Protection Association (NFPA) 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

D. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

A. Submit under provisions of Section 01.3000 - Administrative Requirements.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings: Provide layout drawings and installation details with location and type of hardware required.

D. Verification Samples: For each finish product specified, two samples representing actual product, color, and patterns.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A company regularly engaged in manufacture of products specified in this section, and whose products have been in satisfactory use under similar service conditions for not less than 5 years.

B. Installer Qualifications: A company regularly engaged in installation of products specified in this Section, with a minimum of 5 years experience.

C. Materials: Doors, panels and pilasters, constructed from high density polyethylene (HDPE) resins. Partitions to be fabricated from polymer resins compounded under high pressure, forming a single component which is waterproof, nonabsorbent and has a self-lubricating surface that resists marks from pens, pencils, markers and other writing instruments. Cover all plastic components with a protective plastic masking.

D. Performance Requirements:

1. Fire Resistance: Partition materials shall comply with the following requirements, when tested in accordance with ASTM E 84:
    a. Class A flame spread/smoke developed rating.
    b. Class B flame spread/smoke developed rating.
2. Material Fire Ratings:
    a. National Fire Protection Association (NFPA) 286: Pass.
    b. International Code Council (ICC): Class B.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 WARRANTY

A. Manufacturer guarantees its plastic against breakage, corrosion, and delamination under normal conditions for 25 years from the date of receipt by the customer. If materials are found to be defective during that period for reasons listed above, the materials will be replaced free of charge. Labor not included in warranty.

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. Basis of Design: Basis of Design: Hiny Hiders Toilet Partitions as manufactured by and supplied by Scranton Products.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, the following:

1. ASI Partitions.
2. General Partitions.
3. Metpar.

2.2 MATERIAL

A. Plastic Panels: High density polyethylene (HDPE) suitable for exposed applications, waterproof, non-absorbent, and graffiti-resistant textured surface.

1. Recycled Content; Post Industrial: 25 percent.
2. Recycled Content; Post Industrial: 100 percent.
3. Recycled Content; Post Consumer: 100 percent.

B. Zinc Aluminum Magnesium and Copper Alloy (Zamac): ASTM B 86.

C. Stainless Steel Castings: ASTM A167, Type 304.

D. Aluminum: ASTM 6463-T5 alloy.

2.2 SOLID PLASTIC TOILET COMPARTMENTS

A. Basis of Design: Hiny Hiders Toilet Partitions as manufactured by and supplied by Scranton Products.
1. Style: Floor mounted overhead-braced toilet compartments.

B. Doors, Panels, and Pilasters: 1 inch (25 mm) thick with all edges rounded to a radius. Mount doors and dividing panels based on height of specified system.
1. Door and Panel Height: 55 inches (1397 mm).
2. Aluminum heat sink fastened to bottom edges.
3. Door: Flat
4. Panel Edge: Standard.
5. Pilasters: 82 inches (2083 mm) high and fastened to floor.

C. Panel Color: Traditional Series.
1. As indicated on the Drawings in the Design Selection Summary.

D. Pilaster Shoes: 3 inches (76 mm) high type 304, 20 gauge stainless steel. Secured to pilasters with a stainless steel tamper resistant Torx head sex bolt.

E. Headrail: Heavy-duty extruded 6463-T5 alloy aluminum with anti-grip design. Finish to be clear anodized. Fastened to headrail brackets with stainless steel tamper resistant Torx head sex bolt, and fastened at the top of the pilaster with stainless steel tamper resistant Torx head screws.

1. Headrail Brackets: 20 gauge stainless steel with satin finish. Secured to the wall with stainless steel tamper resistant Torx head screws.

F. Wall Brackets:

1. Stainless Steel Brackets: Stainless steel type 304.
2. Brackets are fastened to pilasters with stainless steel tamper resistant Torx head screws and fastened to the panels with stainless steel tamper resistant Torx head sex bolts.
3. Bracket Type: Stirrup stainless steel double ear.
4. Bracket Type: Stirrup stainless steel single ear.

G. Door Hardware:

1. Continuous Aluminum Hinge:
    a. Length: 54 inches (1372 mm).
2. Wrap-Around Hinges: 8 inches (203 mm) and fabricated from heavy-duty extruded aluminum. Hinges are through-bolted to pilasters and doors with stainless steel tamper resistant Torx head sex bolts. Hinges operate with field adjustable nylon cams. Cams can be field set in 30, 60 or 9 degree increments.
3. Door Strike/Keeper: Heavy-duty extruded aluminum 6436-T5 alloy with a bright dip anodized finish. Secured to pilasters with stainless steel tamper resistant Torx head sex bolts. Bumper shall be made of extruded black vinyl.
    a. Style: 6 inches (152 mm) aluminum.
4. Aluminum Slide Bolt Latch and Housing: Heavy-duty extruded 6463-T5 alloy aluminum. Latch and housing to have a bright dip anodized finish. Slide bolt and button to have a black anodized finish.
5. Doors supplied with one coat hook/bumper and door pull made of chrome plated Zamak.
6. Equip outswing handicapped doors with second door pull and door stop.

2.3 SOLID PLASTIC PRIVACY SCREENS

A. Provide plastic privacy screens in urinal and entry toilet room applications as indicated or scheduled.

B. Panels, and pilasters, if required, 1 inch (25 mm) thick with edges rounded to a radius. Screens to be mounted at 14 inches (356 mm) above the finished floor. Color as selected by Architect from manufacturer's full line of current colors.

1. Aluminum heat sink fastened to bottom edges.
2. Recycled content: Minimum 25 percent.

C. Screen Type: Wall mounted.

1. Urinal Screens: 24 inches (610 mm) wide by 42 inches (1067 mm) high.

D. Wall Brackets: Extruded PVC plastic. Fastened to the panel/pilaster with stainless steel tamper resistant torx head screws and fastened to wall with stainless steel tamper resistant torx head sex bolts.

1. Length of Wall Brackets: 41 inches (1041 mm).
2. Bracket Color: Grey.

E. Aluminum Slide Bolt Latch and Housing: Heavy-duty extruded 6463-T5 alloy aluminum. Latch and housing to have a bright dip anodized finish. Slide bolt and button to have a black anodized finish.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Examine areas to receive toilet partitions, screens, and shower compartments for correct height and spacing of anchorage/blocking and plumbing fixtures that affect installation of partitions. Report discrepancies to the architect.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install partitions rigid, straight, plumb, and level manor, with plastic laid out as shown on shop drawings.

C. Clearance at vertical edges of doors shall be uniform top to bottom and shall not exceed 3/8 inch (9.5 mm).

D. No evidence of cutting, drilling, and/or patching shall be visible on the finished work.

E. Finished surfaces shall be cleaned after installation and be left free of imperfections.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 10.2100

SECTION 10.2123 - CUBICLE CURTAINS AND TRACK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply in this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Curtain tracks and curtain carriers.
2. Cubicle curtains.

B. Related Sections include the following:

1. Division 6 Section "Rough Carpentry" for wood blocking for mounting items requiring anchorage.
2. Division 9 Section "Acoustical Ceilings".

1.3 SUBMITTALS

A. Comply with pertinent provisions of Division 1 Section “Submittals.”

B. Product data:

1. Materials list of items proposed to be provided under this Section;
2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements;
3. Manufacturer's recommended installation procedures.

C. Shop Drawings: Dimensioned drawings in sufficient detail to show suspension, layout, lateral restraint, installation, anchorage, and interface of the work of this Section with the work of adjacent trades.

D. Samples: Samples of each item in full range of colors and patterns available in the specified grades from the proposed manufacturers for selection by the Architect.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Design is based on the use of standard products manufactured by General Cubicle Company, Inc., Telford, PA.

B. Provide products meeting the requirements of these specifications as manufactured by:
   a. Watrows Division of Lansbric Corp., Northbrook, IL;
   b. Beltor Manufacturing Corp., Berlin, NJ;
   c. Imperial Fastener Company, Pompano Beach, FL.

2.2 TRACK AND CARRIERS

A. Where indicated on the Drawings, provide extruded dual channel track and carriers with the following attributes:

1. Track material: 6063-T5 satin finish aluminum;
2. Size: 1-3/8 inches wide by 3/4 inch deep with 1/16 inch minimum wall thickness;
3. Installation: Surface mount;
4. Fastening: Maximum 2 feet on center;
5. Carriers: General Carrier #1062N, nylon axle and wheel combination with nickel plated brass bead chain and hook assembly, one for each foot of track;
6. Other: Provide carrier gates, carrier stops, splices, bends, fasteners, fire-resistive treated blocking, hanger wire, and other standard accessories, as required.

2.3 CUBICLE CURTAINS

A. At each track location shown on the Drawings provide nylon mesh topped curtains with the following attributes:

1. Curtain material: “Oxford Cloth”, 100 percent "Avora FR Polyester, 13.5 ounces per lineal yard, 100 percent washable fabric, complying with NFPA 701 standards, as manufactured by Interspec Fabrics, Allenwood, NJ;
2. Nylon top material: "Mesh 'B'", 100 percent nylon washable mesh with ½ inch openings and flame retardant finishing;
3. Curtains shall be minimum 15 percent wider than total track length and shall hang to within 15 inches of finished flooring;
4. Nylon top width shall be standard 21 inches.
5. Provide in colors and patterns as selected by the Architect from manufacturer’s full range of standard colors and patterns.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. Install the work of this Section, anchoring all components firmly into position, in strict accordance with the original design, the approved Shop Drawings, and the manufacturer's recommended installation procedures and the following:
1. Attach track directly to heavy duty suspended ceiling T-bars at maximum 2 feet centers with #8 panhead sheet metal screws;
2. Where T-bar spacing exceeds 2 feet centers, provide minimum 2 by 3 fire-resistive treated wood blocking between ceiling runners to support track;
3. Provide hanger wire supports to the structure above at each point of track attachment.

C. Adjust installation for smooth and easy operation.

END OF SECTION 10.2123

SECTION 10.2600 – CORNER GUARDS

PART 1 – GENERAL

1.01 SUMMARY
- A. Corner guard system for wall protection:

1.02 SECTION INCLUDES
- A. Stainless Steel Corner Guard Systems

1.03 SUBMITTALS
- A. Product data for each type of corner guard specified.
- B. Detail drawings indicating mounting details with the appropriate fasteners for specific project substrates.
- C. Samples for verification purposes of corner guard, 6" (152mm) long, in full size profiles of each type and color indicated.
- D. Cleaning and maintenance instructions for door and wall protection systems.

1.04 DELIVERY, STORAGE AND HANDLING
- A. Deliver materials in unopened factory packaging to the jobsite and store in original packaging in a climate controlled location away from direct sunlight.

1.05 PROJECT CONDITIONS
- A. Products must be installed in an interior climate controlled environment.

1.06 WARRANTY
- A. Standard IPC Limited Lifetime Warranty against material and manufacturing defects.

PART 2 – PRODUCTS

2.01 MANUFACTURER
- A. Basis-Of-Design Product: Inpro Corporation, IPC Door and Wall Protection Systems PO Box 406 Muskego, WI 53150 USA; Telephone: 800.222.5556, Fax: 888.715.8407, Website: www.inprocorp.com.
  1. Submit comparable products of one the following for approval by architect:
     a. Insert name of manufacture of comparable product
     b. Submit requests for substitution in accordance with Instructions to Bidders and Division 01 General Requirements
     c. Alternate Manufacturers: Wolf Gordon, CSI Construction Specialties

2.02 MANUFACTURED UNITS

A. Corner Guards
   1. SS Corner Guards:
      a. 1½"(38mm) x 1½"(38mm) x 96" (2.43m) x ⅛" radius, Screw-on, 304 Stainless Steel, 16 gauge - SAS-181128H-304

2.03 MATERIALS
A. Stainless Steel: Corner Guards shall be manufactured from Type 430, 16 gauge Stainless Steel.

2.04 COMPONENTS
A. Attachment
   1. Fasteners: Pre-drilled beveled holes and Phillips head screws.

2.05 FINISHES
A. Stainless steel: No. 4 satin finish.

PART 3 – EXECUTION

3.01 EXAMINATION
A. Examine areas and conditions in which the corner guard systems will be installed.
   1. Complete all finishing operations, including painting, before beginning installation of corner guards.
B. Wall surface shall be dry and free from dirt, grease and loose paint.

3.02 PREPARATION
A. Surface Prep: Prior to installation, clean the substrate to remove dust, debris and loose particles. Ensure the substrate is sound and per project plans.
B. Acclimate product in temperatures between 65°F and 80°F [18°-27°C] and a humidity level less than 80% 24 hours in advance of installation.
C. The area of installation must temperature and humidity controlled for at least 48 hours after installation.

3.03 INSTALLATION
A. General: Locate the corner guard as indicated on the approved detail drawing for the appropriate substrate and in compliance with the IPC installation instructions. Install corner guard level and plumb at the height indicated on the drawings.
B. Installation of Stainless Steel Corner Guards:
   1. Surface must be dry, clean and properly sealed.

2. Cement on: Apply a bead of PL Premium Heavy Duty Adhesive in a zigzag pattern over the back of each wing of the corner guard. Position corner guard on the wall and apply pressure until a tight fit is achieved.
3. Screw on: Position the corner guard on the wall and attach it using the supplied screws.
4. Remove the protective plastic covering from the exposed surface of the corner guard.

3.04 CLEANING

A. At completion of the installation, clean surfaces in accordance with the IPC clean up and maintenance instructions.

END OF SECTION 10.2600

SECTION 10.2813 – TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Washroom accessories.
2. Custodial accessories.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Construction details and dimensions.
2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Material and finish descriptions.
4. Features that will be included for Project.
5. Manufacturer's warranty.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated on Drawings.
2. Identify products using designations indicated on Drawings.

C. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.3 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.

1.4 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.5 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.

B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359-inch (0.9-mm) minimum nominal thickness.

C. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.

D. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

F. Finish: Satin Stainless

G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.2 TOILET ROOM / WASHROOM ACCESSORIES

A. Basis-of-Design Products: The design for accessories is based on products indicated on the Toilet Accessories Schedule on the drawings. Subject to compliance with requirements, provide the named product or a comparable product by one of the available manufacturers indicated.

a. Basis-of-Design Products by Bobrick Washroom Equipment, Inc.

B. Available Manufacturers: The design for accessories is based on products indicated on the Toilet Accessories Schedule. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

a. American Specialties, Inc. (ASI)

b. Bradley Corporation.

C. Toilet Accessories Schedule: Provide toilet accessories where shown on Drawings or as provided in these specifications. Provide products of the same manufacturer for each type of accessory unit and for units exposed in the same area.

D. Toilet accessories shall be of the quality as manufactured by Bobrick. The accessories which are indicated on the drawings are listed with Bobrick catalog numbers for convenience in identifications only. The use of a catalog numbers as a description of an item shall be taken to include the description or specification for the item in the manufacturer's catalog.

E. In addition to the accessories scheduled on the Drawings, provide the following accessories at locations as directed by the Architect.

   a. Mop and Broom Holder (B223 x 36)

   b. Quantity: 4.

2.3 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N) when tested according to method in ASTM F 446.

C. Provide solid wood blocking or 12 gauge steel anchor plates behind gypsum board surfaces at each toilet accessory for secure anchorage.

D. Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, according to manufacturer's instructions for type of substrate involved.32

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations

END OF SECTION 10.2813

SECTION 10.4400 – FIRE PROTECTION SPECIALTIES

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Section includes portable, hand-carried, fire extinguishers, and mounting brackets for fire extinguishers.

2. Section includes fire protection cabinets for the following:
   a. Portable fire extinguishers.
   b. Fire Protection Cabinets

B. Related Sections:

1. Division 10 Section "Signage" for directional signage to out-of-sight fire extinguishers and cabinets.
2. Division 26 Sections or the Drawings for low-voltage wiring for fire protection cabinet alarms.
3. Division 26 Section "Interior Lighting" or the Drawings for fire extinguisher location lights.

1.2 SUBMITTALS

A. Product Data:

1. Fire Extinguishers: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

2. Fire Protection Cabinets: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets. Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

B. Product Schedule: For fire extinguishers and fire protection cabinets.

1. Coordinate final fire extinguisher schedule with fire protection cabinet schedule to ensure proper fit and function.

2. Coordinate final fire protection cabinet schedule with fire extinguisher schedule to ensure proper fit and function

C. Operation and Maintenance Data: For fire extinguishers and fire protection cabinets to include in maintenance manuals.

D. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments other work.

E. Samples for Initial Selection: For each type of fire protection cabinet indicated.

F. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Size: 6 by 6 inches (150 by 150 mm) square.

G. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FMG.

C. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to fire extinguishers including, but not limited to, the following:

a. Schedules and coordination requirements.

2. Review methods and procedures related to fire protection cabinets including, but not limited to, the following:

a. Schedules and coordination requirements.

1.4 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

B. Coordinate size of fire protection cabinets to ensure that type and capacity of fire hoses, hose valves, and hose racks indicated are accommodated

C. Coordinate sizes and locations of fire protection cabinets with wall depths.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
    a. Failure of hydrostatic test according to NFPA 10.
    b. Faulty operation of valves or release levers.
2. Warranty Period: Six years from date of Substantial Completion.

PART 2 – PRODUCTS

2.1 PORTABLE FIRE EXTINGUISHERS

A. Multi–purpose dry chemical fire extinguishers, 4A:60B:C UL rating:
1. Larsen's Manufacturing Company, Model "MP10".
2. Potter Roemer, Model Number 3010.
3. Or alternative of the quality necessary to meet the specifications.

B. Carbon dioxide fire extinguishers, 10B:C UL rating:
1. Larsen's Manufacturing Company, Model "CD 10."
2. Potter Roemer, Model Number "3410."
3. Or alternative of the quality necessary to meet the specifications.

C. Wet chemical fire extinguishers, 2A-K UL rating for use in kitchens:
1. Larsen's Manufacturing Company, Model "WC-6L."
2. Or alternative of the quality necessary to meet the specifications.

D. Where indicated on the Drawings, and at each fire extinguisher cabinet, provide one multi-purpose dry chemical fire extinguisher with UL rating.

E. Provide four carbon dioxide fire extinguishers with UL rating to be located by Architect.

F. Provide wet chemical fire extinguishers with UL rating at all Kitchens.

G. Provide manufacturer's standard wall mounting brackets for all portable fire extinguishers except those furnished in cabinets.

H. Service, charge, and tag each fire extinguisher not more than five calendar days prior to the Date of Substantial Completion of the Work as that Date is established by the Architect.

2.1 FIRE PROTECTION CABINET (FEC)

A. Cabinet Type: Suitable for fire extinguisher.

1. Basis of Design Cabinet Type: The following cabinet(s) are listed with a specific manufacturer's catalog number for convenience in identification only. The use of a catalog number as a description of the cabinet shall be taken to include the specification for the item. Equal products from the available manufacturers listed in this section will be acceptable.
    a. Larsen's "Cameo Series #C2409-R" (Fully recessed - flat trim) or "Cameo Series #FSC2409-R" (Fully recessed - flat trim) in all fire-rated walls.
    b. J. L. Industries' "Clear VU Series #1515-G25" (Fully recessed - flat trim) or "Clear VU Series #1515-G25FX" (Fully recessed - flat trim) in all fire-rated walls.
    c. Cabinet bubble projection cannot exceed 4 inches.

2. Available Manufacturers: Subject to compliance with requirements, manufacturers whose products may be considered to be included in the Work, include:

    a. J. L. Industries, Inc.; a division of Activar Construction Products Group.
    b. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
    c. Larsen's Manufacturing Company.
    d. Modern Metal Products, Division of Technico, Inc.
    e. Potter Roemer LLC.

B. Cabinet Construction: Manufacturer's standard enameled steel box, with trim, frame, door and hardware to suit cabinet type, trim style, and door style indicated. Weld all joints and grind smooth. Miter and weld perimeter door frames.

C. Fire-rated Cabinet Construction:

1. Construct fire-rated cabinets with double walls fabricated from 0.0428-inch- (1.1-mm-) thick, cold-rolled steel sheet lined with minimum 5/8-inch- (16-mm-) thick, fire-barrier material. Provide factory-drilled mounting holes.

D. Cabinet Material:

1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
2. Acrylic Bubble: One piece.

E. Fully Recessed Cabinet: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.

1. Trimless with Concealed Flange: Surface of surrounding wall finishes flush with exterior finished surface of cabinet frame and door, without overlapping trim attached to cabinet. Provide recessed flange, of same material as box, attached to box to act as drywall bead.
2. Trimless with Hidden Flange: Flange of same metal and finish as box overlaps surrounding wall finish And is concealed from view by an overlapping door.
3. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

F. Cabinet Trim Material: Steel sheet.

G. Door Material: Steel sheet.

H. Door Style: JL Indust. “Clear VU Series, or Larsen's "Cameo Series (Full bubble with frame).

I. Door Glazing: Molded acrylic bubble.

1. Acrylic Bubble Color: Clear, transparent.

J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide projecting lever handle with cam-action latch or recessed door pull and friction latch.
2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

K. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish..
2. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
    a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
        1) Location: Applied to cabinet door.
        2) Application Process: Silk-screened.
        3) Lettering Color: As selected by Architect.
        4) Orientation: Vertical.

L. Finishes:

1. Manufacturer's standard baked-enamel paint for the following:
    a. Exterior of cabinet, door, and trim except for those surfaces indicated to receive another finish.
    b. Interior of cabinet and door.
2. Steel: Baked enamel or powder coat.

2.2 FABRICATION

A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.
3. Prepare doors and frames to receive locks.
4. Install door locks at factory.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13mm) thick.
2. Fabricate door frames of one-piece construction with edges flanged.
3. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.3 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.4 FIRE PROTECTION CABINET STEEL FINISHES

A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with.After cleaning, apply a conversion coating suited to the organic coating to be applied over it.

B. Factory Prime Finish: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

C. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where recessed cabinets will be installed.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.
2. Proceed with installation of fire extinguishers only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for recessed fire protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION OF FIRE PROTECTION CABINETS

A. General: Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

END OF SECTION 10.4400

SECTION 10.5030 – TURNOUT GEAR LOCKERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Design, fabrication and installation of wall mounted turnout gear lockers as specified herein.

B. Design, fabrication and installation mobile turnout gear lockers as specified herein.

1.2 RELATED SECTIONS

A. Division 00 Section “ARRA Grant Requirements” for “The Buy American Act” requirements as applicable.

B. Section 10: Metal Lockers.

C. Sections of Division 16: electrical as applicable.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s product data and installation instructions.

B. Shop Drawings: Submit manufacturer’s shop drawings for each individual run of lockers.

C. Samples: Submit manufacturer’s standard color samples.

D. Owner’s Manual: Provide maintenance manual at closeout.

E. Warranty: Submit manufacturer’s standard warranty.

1.4 QUALITY ASSURANCE

A. Manufacturer shall have a minimum of fifteen years experience in the direct manufacture of lockers.

B. Installer Qualifications: Installer shall have experience necessary to assure lockers are installed properly and according to manufacturer’s instructions.

C. Reference:

1. ASTM A513 – Minimum properties of Electric-Resistance-Welded Carbon Allow Steel Mechanical Tubing

2. ASTM A510 - Minimum properties of Wire Rods and Coarse Round Wire, Carbon Steel and Alloy Steel

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers with labels identifying product and manufacturer's name.

B. Storage: Store materials in a clean dry area.

C. Handling: Protect materials and finish during installation and handling to prevent damage.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Acceptable Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. GearGrid Corporation, 670 SW 15th Street, Forest Lake, MN 55025. Toll-free 888-643-6694. Phone 651-464-4468. Fax 651-464-4780. Web site www.geargrid.com. Email sales@geargrid.com.

2. DS fabrications : Locker: Supreme WM

3. Global Industrial, Locker: Red Rack

2.2 TURNOUT GEAR LOCKER FABRICATION

A. Model: GEARGRID Wall Mounted Storage System.

B. Locker Sizes: (Please reference project drawings for indicated sizes and quantity)

1. Widths: 20", 24"

2. Depths: 20"

3. Height: 74.5”

C. Model: GEARGRID Mobile Unit

1. 4-pack unit having 4 openings on each side back-to-back

a. 20” unit overall dimensions: 83” high x 43” wide x 39” deep

b. see drawings for quantity

1. 2-pack unit having 2 openings on one side

a. 20” unit overall dimensions: 83” high x 43” wide x 20” deep

b. see drawings for quantity

D. Construction: Units shall be welded at all applicable joints. Forming of metal shall be completed by standard cold-forming operations. Use of fasteners will only be required to allow for knock-down shipping, securing units to mounting surface and on applicable accessories.

E. Vertical Dividers:

1. Outer Frames: 1.25” O.D. x 16 gauge wall thickness ASTM A513 steel tubing.

2. Inner Grid: .25” diameter ASTM 510 cold drawn steel wire resistance welded to a 3” square pattern.

3. Inner Grid wires must be full length and width of inside vertical divider frame. Wires not running full length or width, thus creating exposed wire ends will not be acceptable.

4. Inner Grid wires must run horizontally and vertically creating a square or rectangular grid pattern only. Grid wires not creating a square or rectangular grid pattern will not be acceptable.

5. Inner Grid wires shall intersect and cross all perpendicular wires, and shall be welded at all intersections.

F. Back Panel:

1. Required on each locker to protect the locker contents and wall substrate, as well as provide an additional panel for accessory attachment.

2. Grid: .25" diameter ASTM 510 cold drawn steel wire resistance welded to a 3" square pattern.

3. Back panel must engage and be secured to vertical dividers via horizontal wires which extend into mounting holes pre-drilled in vertical dividers. Back panels are sandwiched between vertical dividers, preventing them from being removed after assembly is complete.

4. Inner Grid wires must be full length and width of inside vertical divider frame. Wires not running full length or width, thus creating exposed wire ends will not be acceptable.

6. Inner Grid wires must run horizontally and vertically creating a square or rectangular grid pattern only. Grid wires not creating a square or rectangular grid pattern will not be acceptable.

5. Inner Grid wires shall intersect and cross all perpendicular wires, and shall be welded at all intersections.

G. Shelves: (1) Upper, (1) Lower. .25" diameter ASTM 510 cold drawn steel wire resistance welded and cold formed. Upper shelf shall include an integrated 20 gauge steel bracket to accept a 2" x 16" name placard(not included), unless doors are selected as an option, in which case the name placard holder will be integrated into the door.

H. Apparel Hooks: (3) per locker opening. .192" diameter ASTM 510 cold drawn steel wire resistance welded, cold formed and powder coated. Apparel hooks must securely engage and snap onto side or back grid, to prevent unintentional disengagement of hook.

I. Base Assembly for Mobile Unit: Base frame shall be manufactured from 1.25" x 11 gauge wall thickness ASTM A513 square steel tubing. Each unit to be supplied with four (4) casters per unit. Casters to have a 250 lbs. capacity per each caster. Each caster is a swivel model with brake.

2.3 ACCESSORIES

A. Hang Bar

1. Hang Bars must be manufactured to allow each locker user to install at their desired height. Hang Bars that span multiple locker openings are not acceptable.

2. Tube: 1.25”O.D. x 16 gauge 304 stainless steel tubing.

3. Brackets: Allow Hang Bars to be securely attached to each vertical divider, powder coated.

C. Heavy Hanger:

1. .25” diameter 304 stainless steel wire cold formed and resistance welded.

2. Black vinyl coating on hook end.

D. Gear Dryer Hanger:

1. .25” diameter 304 stainless steel wire cold formed and resistance welded. Includes formed loops to prop open sleeves on jackets to promote better circulation throughout the garment.

2. Black vinyl coating on hook end.

E. Glove Drying Hanger:

1. .25” diameter 304 stainless steel wire cold formed and resistance welded.

2. Black vinyl coating on hook end.

F. Helmet Holder

1. .25” diameter ASTM 510 cold drawn steel wire resistance welded. Powder coated finish in specified color.

G. Secure Box:

1. 6” wide x 6” high x 12” deep 6061 Aluminum enclosure with hinged, lockable door at outer end. Design shall include an integrated mail slot. Powder coated finish in specified color.

1. Shelf spanning across the top of the lockers for additional gear storage above lockers. .25”

diameter ASTM 510 cold drawn steel wire resistance welded to a 3" square pattern. Powder coated finish in specified color.

2.4 FINISH

A. General: All system components excluding assembly and mounting hardware and stainless steel components are to receive the standard finish.

B. Standard Finish: Components to be cleaned using a phosphatized bath, clear water rinse and electro-statically coated with a durable and UV-stable TGIC powder coating process. Thickness of applied finish shall be 3 – 4 mm for added protection.

1. Anti-Corrosive Primer:

C. Color: RED (Manufacturer must provide a minimum 7 standard color choices for selection)

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine area to receive lockers. Notify architect if area are not acceptable. Do not begin Installation until unacceptable conditions have been corrected.

3.2 INSTALLATION

A. Install lockers in accordance with manufacturer's instructions.

B. Use manufacturer's hardware for assembly.

C. Anchor to mounting surface with proper hardware.

END OF SECTION 10.5030

SECTION 10.5100 – LOCKERS

PART 1-GENERAL

1.01 Summary

A. Section includes:
1. Solid phenolic lockers

C. References

1. UL – GREENGUARD certified low emitting materials.
2. ASTM - B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
3. ASTM – A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

1.02 Submittals

A. Product Data: Submit manufacturer's technical data for materials, fabrication, finishing, fastenings, hardware, and installation details.

B. Shop Drawings: Submit shop drawings indicating room sizes, layout, locker dimensions, material thickness, trim, hardware, finishes, locks, base, doors, accessories, and installation details.

C. Samples: Submit samples of edge details, colors, patterns, finishes, and textures.

D. Closeout Documents: Submit the following:
1. Operation and maintenance data
2. Warranty

1.03 Quality Assurance

A. Qualifications:
1. Fabricator shall be capable of providing field service representation.
2. Installer shall be approved by the manufacturer and be experienced in performing work of similar size and scope.

B. Pre-installation Meeting: Conduct pre-installation meeting prior to installation to verify project requirements and conditions.

1.04 Delivery, Storage and Handling

A. Storage and Handling: Store materials in an enclosed shelter providing protection from damage, temperature, humidity, and exposure to the elements.

B. Delivery: Deliver materials in the manufacturer's original protective packaging.

1.05 Coordination and Project Conditions

A. Field Measurements: Before material fabrication, verify actual field measurements and show actual measurements on shop drawings.

B. Coordination: Coordinate field measurements with fabrication schedule and construction progress to avoid construction delays.

1.06 Warranty

A. Submit executed copy of the Summit Lockers 20-year warranty against defects in material signed by an authorized representative of Summit Lockers.

PART 2 – PRODUCTS

2.01 SOLID PHENOLIC LOCKERS

A. Manufacturer: Subject to compliance with requirements, provide lockers by one of the following. Prior approvals submitted to contractor 30 days prior to bid will be considered.

1. Summit Lockers Inc.
2. Clubline Lockers.
3. Spectrum Lockers.
4. Titan Lockers
5. Columbia Lockers

B. Basis of Design: Summit Solid Phenolic lockers as manufactured by Summit Lockers Inc. (138 McLeod Road, Columbia, SC 29203, 803-403-8816, info@summitlockers.com)

C. Size
1. Provide 72” high X 15” wide X 15” Deep lockers

2.02 MATERIALS

A. Panel Material:
1. Decorative papers impregnated with a melamine resin on faces with a clear protective overcoat and integrally compression molded within a core consisting of solid phenolic impregnated kraft papers.
2. Fire Rating: Core or panel material shall meet fire Class B resistance per ASTM E84

B. Doors, End Panels, Filler Panels, Sloped Top & Ancillary Panels:
1. Material thickness: 1/2” (13mm) thick solid phenolic composite material.
2. Corners: Eased edges
3. Door Fastening: Blind fastening unless through bolts are requested
4. Color: Wilsonart, Formica, Tespa as selected by architect from full range of premium colors from mfg.

C. Locker Body Construction
1. Tops, Bottoms, and Shelves: Minimum 3/8” (10mm) thick solid phenolic composite material with ventilation holes.
2. Sides and Backs: Minimum 5/16” (8mm) thick solid phenolic composite material.
3. Wall Mounting Cleats: Minimum 1/2” (12mm) thick solid phenolic.
4. Mortise & Tenon Joints: All tops, bottoms and shelves use mortised joints and are secured with mechanical fasteners.
5. Exposed edges: Straight profile; eased edges to remove sharpness; machine polished and free from tooling imperfections.
6. Color: Wilsonart 1573 Frosty White.

D. Hardware
1. Hinges: Concealed 6-Knuckle Stainless Steel hinge. Opens 90°. Include three (3) hinges for doors > 36” tall or two (2) for all other heights.
2. Interior Side hooks:
   a. Material: Stainless steel. Plastic and nylon hooks are not acceptable.
   b. Two per opening for all openings 30” tall or greater.
3. Fasteners: All fasteners shall be stainless steel.
4. Door Identification Plates:
   a. Material: 1.75” x 6.25” black plastic with reverse engraved numbers and surface mounted with permanent adhesive.
   b. Fonts to be a minimum 1/2” high and up to four characters.
   c. Numbering sequence to be provided by architect.

5. Door Locks:
   a. Stainless steel hasp bar for customer supplied padlock
   b. Other Locks as specified. Options include: Digital Day Use, Digital Assigned Use, Mechanical Day Use, Mechanical Assigned Use, Key Lock, Coin Retain Lock, Coin Return Lock, Combination Lock, Card Locks.

E. Ventilation:

1. Vertical ventilation: Provide six 5/16" (8mm) diameter ventilation holes on tops, bottoms, and intermediate shelves. Provide three 5/16" (8mm) diameter ventilation holes on "Z" type intermediary shelves.
2. Horizontal ventilation: Provide ventilation around the edge of the door equal to at least 1.43 square inches of ventilation surface area per linear foot of door perimeter.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine site conditions before locker installation. Notify architect of unacceptable areas. Do not install lockers until unacceptable conditions have been corrected.

3.02 INSTALLATION

A. Install *ten* (10) of the specified lockers in the personal decon room . see equipment plans

B. Install lockers installed secured, plumb, level, square, and flush. Base by others must be flat and level.

C. Install all required trim, fillers, end panels, and closures per manufacturer's instructions.

D. Use hardware supplied or recommended by the manufacturer.

E. Attach number plates to doors as indicated on shop drawings.

F. Correct and/or replace damaged components as directed by architect.

G. General contractor to supply base as required for lockers as indicated by locker manufacturer. Match surrounding finish base material .

3.03 ADJUSTMENT

A. Adjust doors and locks for smooth operation without binding.

B. Lubricate door hinges and locks per manufacturer's instructions.

3.04 CLEANING

A. Clean all surfaces in accordance with manufacturer's instructions.

B. Do not use abrasive cleaners.

END OF SECTION 10.5126

SECTION 10.5113 – BUNK ROOM LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

Personal Storage Lockers with built-in bench drawers

(Note: all lockers include electrical functionality as required. Tiered lockers excluded)

(Note: all Personal Storage Lockers, Personal Storage with built-in bench drawers, and Personal Storage Lockers with built-in external access drawers must include environmental ventilation functionality as required)

B. Related Work, Not Furnished:

1. Finish floor covering material and installation.
2. Attachment to building HVAC system and balancing air flow through locker system. Manufacturer will provide guidance only upon request.

Finish floor covering materials and installation.

C. Related Sections:

[Sections in Division 9 – Finishes, relating to finish floor and base materials]

1.3 REFERENCES

A. American National Standards Institute (ANSI) Standards:

Applicable standards for fasteners used for assembly.

B. American Society for Testing and Materials (ASTM) Standards:

Applicable standards for steel sheet materials used for fabrication

Applicable standards for the testing of electrostatically applied Powder Coat Paint

C. American Institute Of Steel Construction (AISC) Standards:

Applicable standards for steel materials used for fabrication.

1.4 DESCRIPTION

A. General: Welded Metal Lockers only with end-user reconfigurable interior. Specialized lances to provide the flexibility of on-site, end-user reconfiguration/addition of internal components anytime, anywhere, now or in the future.

B. Finishes:

Fabricated Metal Components and Assemblies: All components to be painted with an electro-statically applied Powder Coat paint that can meet or exceed test requirements set out by ASTM standard D3451-06 Standard Guide for Testing Coating Powders and Powder Coatings.

C. Sizes:

Personal Storage Lockers with built-in bench drawers, and Personal Storage Lockers with built-in external access drawers: Reference drawings.

1.5 PERFORMANCE REQUIREMENTS

A. Design Requirements:

Limit overall width not to exceed specified nominal width; locker width designed for zero growth.

B. Seismic Performance: Provide Welded Metal Lockers capable of withstanding the effects of earthquake movement when required by applicable building codes.

1.6 SUBMITTALS

A. Product Data: Submit manufacturer's product literature and installation instructions for each type of welded metal locker required. Include data substantiating that product to be furnished comply with requirements of the contract documents.

B. Shop Drawings: Show fabrication, assembly, and installation details, including descriptions of procedures and diagrams. Show complete locker installation layout, including quantities, locations and types of accessory units required. Include notations and descriptions of all installation items and components.

Show installation details at non-standard conditions, if any.

Provide layout, dimensions, and identification of each unit, corresponding to sequence of installation procedures.

Provide installation schedule and procedures to ensure proper installation.

C. Samples: Provide minimum [3] inches example of each color and texture on actual substrate for each component to remain exposed after installation.

D. Selection Samples: For initial selection of colors and textures, submit manufacturer's color charts, consisting of actual product pieces, showing full range of colors and textures available.

E. Warranty: Submit draft copy of proposed warranty for review by the [Architect/Engineer].

F. Maintenance Data: Provide written documentation of the manufacturer's statement, claiming the maintenance free nature of the product.

G. Reference List: Provide a list of recently installed welded metal lockers to be visited by owner, architect, and contractor. Intent of list is to aid in verifying the suitability of manufacturer's products and comparison with materials and product specified in this section. Include contact name, address, and phone numbers.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Engage an experienced manufacturer who is ISO 9001:2008 certified for the design, production, installation and service of welded metal lockers. Furnish certification attesting ISO 9001:2008 quality system registration.

B. Installer Qualifications: Engage an experienced installer who is the manufacturer's authorized representative for the specified products for installing welded metal lockers.

Minimum Qualifications: 1-year experience installing welded metal lockers of comparable size and complexity to specified project requirements.

1.8 DELIVERY, STORAGE AND HANDLING

A. Follow manufacturer's instructions and recommendations for delivery, storage and handling requirements.

1.9 PROJECT CONDITIONS

A. Field Measurements: Verify quantities of welded metal locker units before fabrication. Indicate verified measurements on shop drawings. Coordinate fabrication and delivery to ensure no delay in progress of the work.

B. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating welded metal lockers units without field measurements. Coordinate construction to ensure actual dimensions correspond to established dimensions.

1.10 WARRANTY

A. Provide a written warranty, executed by Contractor, Installer, and Manufacturer, agreeing to repair or replace units which fail in materials or workmanship within the established warranty pe-

riod. This warranty shall be in addition to, and not a limitation of, other rights the Owner may have under General Condition's provisions of the Contract Documents.

B. Limited Lifetime Warranty: Subject to the terms in the written warranty, warrant the original purchaser exclusively that the locker frames manufactured by it will be free from defects in materials and workmanship for the lifetime of the locker.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: : FreeStyle™ Personal Storage Lockers, FreeStyle™ Personal Storage with built-in bench drawers, Personal Storage with built-in external access drawers, FreeStyle™ Personal Storage Lockers in Multi-Tier configurations; based upon welded metal lockers manufactured by Spacesaver Corporation, 1450 Janesville Avenue, Fort Atkinson, Wisconsin 53538-2798. Telephone: 800-492-3434.

B. Acceptable Manufactures:

1. Columbia Lockers
2. Clubline

2.2 BASIC MATERIALS

A. General: Provide materials and quality of workmanship, which meets or exceeds established industry standards for products specified. Use furniture grade sheet metal, solid hardwood benches and fasteners for component fabrication unless indicated otherwise. Material thicknesses/gauges are manufacturer's option unless indicated otherwise.

2.3 LOCKER TYPES

A. Personal Storage Lockers. Provide personal storage lockers with built-in bench drawers by Spacesaver Corporation.

B. Note

1. All locker types (except Multi-Tier) to be equipped with the functionality of attaching a modular electrical system as required.
2. All locker types to be equipped with the functionality of attaching a continuous sloped top.

2.4 MANUFACTURED COMPONENTS

A. Welded Frame:

1. The welded frame must consist of top, bottom, back, and sides constructed of a minimum of 18-gauge or [1.214] millimeters steel. All frame components shall be joined using resistance welding. Riveting of structural members will not be permitted.
2. Horizontal front flanges will be a minimum of [2] inches or [50.8] millimeters. Vertical front flanges will be a minimum of [1] inch or [25.4] millimeters. Horizontal and vertical flanges will overlap and be secured with a minimum two (2) resistance welds per corner.
3. Corner gussets shall be MIG and spot welded in each of the four front corners of the locker for increased stiffness and rigidity.
4. Provide side panel lances evenly spaced on [3] inch or [76.2] millimeter centers. Lances to provide the flexibility of on-site, end-user reconfiguration/addition of internal components anytime, anywhere, now or in the future.
5. Bench Housing for built-in bench drawer
    a. Welded frame construction shall consist of top, bottom, and side components joined by using resistance welding. Riveting of bench housing structural members will not be permitted.
    b. Corner gussets shall be welded in the two (2) front bottom corners of the bench housing for increased stiffness and rigidity.
    c. Horizontal front flanges will be a minimum of [1] inch
    d. Vertical front flanges will be a minimum of [1] inch
    e. Horizontal and Vertical front flanges will overlap and shall be secured with minimum of one (1) resistance weld per corner.
    f. Side panels – Lances symmetric and evenly spaced to provide optimum component locations (standard based on [3] inch on center vertical placement to match mating locker lance design).
    g. Return flanges on housing to securely fasten housing to welded frame of locker.
    h. Base of bench housing shall include four (4) 3/8”-16 UNC threaded weld-nuts and corresponding leveling feet.
    i. Top of bench housing shall include hole pattern for mating bench seat.
    j. Sides of bench housing shall include mounting holes in the event lockers are ganged together.
6. Lockers with built-in bench drawer and built-in external access drawer shall have intermediate base shelf with interlocking mechanism for securing drawer when locker door is closed. Cable release of lockers not acceptable.
7. Provide four (4) [0.875] inch diameter electrical knock-outs per locker, two (2) located on top of the locker in both right and left rear corners, and two (2) located in the back of locker centered at a distance no greater than [24] inches from the top and bottom. Knock-outs allow end-user flexibility of adding electrical capability to lockers.

8. Provide a minimum of four (4) duplex receptacle electrical knock-outs per locker; to be used with a UL listed manufactured electrical wiring system as required. This manufactured electrical wiring system is a simple, unique, flexible, and cost-effective method of providing electrical capability to the lockers. This electrical system can be added in the future.
    a. Top of the locker shall have four (4) duplex electrical knock-outs.
    b. Top of locker shall have electrical duplex receptacle knock-outs located on both right and left side of locker.
    c. Back panel of locker shall have a minimum of two (2) duplex electrical knock-outs.
    d. Back of locker shall have electrical duplex receptacle knock-outs located on both right and left side of locker and no farther than [24] inches from the top of the locker.
9. Provide ventilation holes in top of locker to allow mechanically extracted air to be pulled up through the locker system as required. Ventilation shall be controlled by eight (8) evenly spaced [0.625] diameter holes. Proper ventilation system ensures unpleasant odors are removed from locker system.
10. Lockers shall be prepared with mounting holes for use with the continuous sloped top system.
11. Lockers shall be prepared with mounting holes for attaching necessary trim components
12. Locker shall be prepared with mounting holes for ganging lockers back-to-back or side-by-side
13. Base of lockers shall include four (4) 3/8”-16 UNC threaded weld-nuts and corresponding leveling feet.
14. Base shelf for lockers with built-in external access drawers and bench drawers shall have holes to accommodate double-door lock rod and door stop bracket. (Only on [24] inch wide and larger)
15. End Panels: End Panels with no exposed fasteners shall be provided on the end of each locker run; thus, providing a clean and aesthetically pleasing appearance.
16. All locker sizes and types to be specified by architect.
    a. Width:
        1) Personal Storage Locker with built-in bench drawer or external access drawer:
    b. Height:
        1) Personal Storage Locker with built in bench drawer or external access drawer:

c. Depth:

1) All lockers [24] inches

2) Bench drawers: [36] inches

c) Bench seat depth [13.0] inches

c) Leading edge of bench seat to extend [1.125] inches from front of bench drawer

B. Ventilation:

1. Provide ventilation holes in top of locker to allow mechanically extracted air to be pulled up through the locker system as required. Ventilation shall be controlled by eight (8) evenly spaced [0.625] inch diameter holes. Proper ventilation system ensures odors are removed from locker system.
2. Provide an adjustable air baffle for system balancing when mechanical air extraction is used. Upon balancing system, air baffle shall be secured with a fastener to maintain ventilation setting.
3. Provide louvered air vents in bottom of the main locker door/s to allow mechanically extracted air to be pulled up through the locker system.
4. Provide louvered air vents in drawer front when built-in bench drawer or built-in external access drawer models are required.
5. Minimum [0.500] inch gap between back of shelving components and back of locker to provide uninterrupted air flow up the rear of the locker system.
6. Minimum [2.00] inches gap between front of shelving and locker door to provide uninterrupted air flow up the front of the locker system.
7. Multi-Tier ventilation is provided thru door panels
8. Upon request manufacturer shall provide HVAC tech data to serve as a guideline for the General Contractor and HVAC Contactor. It is the General Contractor and/or HVAC contractors' responsibility to establish/balance air flow through locker system according to building HVAC constraints.

C. Electrical

1. Shall provide four (4) electrical knock-outs per locker as described in section 2.4-A item 7. This feature provides the end-user the opportunity for hard wire electrical connection points for each locker. End-user or General Contractor is responsible for final electrical installation.
2. Shall provide a minimum of four (4) duplex receptacle electrical knock-outs per locker as described in section 2.4-A item 8.
3. Shall provide UL Listed manufactured electrical wiring system as required. This manufactured electrical wiring system provides connection for a maximum of 78 receptacles

per hardwired power in-feed (Note: total number of receptacles is dependent on load requirements). This manufactured electrical wiring system is a modular, unique, flexible, and cost-effective method of providing electrical capability to the lockers.

D. Drawers (for bench drawer and external access drawer):

1. Drawer body wrapper shall have welded frame construction. Riveting of structural members will not be permitted.
2. Drawers for locker with built-in bench drawers and built-in external access drawers shall have box-formed drawer front.
3. Provide interlock system for securing drawer when main locker doors are closed and provide access only when main locker door/s is opened. Cable drawer release mechanism will not be tolerated.
4. Built-in bench drawer shall have a nominal [36] inches depth.
5. Provide a flush mounted pull handle.
6. Drawer Slides: Provide [200] lbs maximum load capacity and pass 50,000 cycle performance testing (Max. load, uniform distribution) (Test data to be provided by manufacturer upon request)
7. Drawer base minimum [21] inches drawer extension
8. Bench drawer minimum [26.5] inches drawer extension
9. Provide louvered air vents in drawer front when built-in bench drawer or built-in external access drawer models are required.
10. Provide capability of attaching glides for Body Armored Drying Rack, as requested.

E. Bench Seat:

1. Provide 13.0 inches deep laminated kiln dried maple bench seat; material thickness [1.25]
2. Front (leading edge) of bench seat to have [.625] inch or radius bull nose.
3. Finish of bench seat shall be sanded smooth and have two (2) coats of catalyzed varnish applied.

F. Single-Piece Welded Doors (Single and Double Door Models):

1. Shall be formed from two (2) pieces of minimum 18-gauge cold rolled steel box formed and welded together using modern GMAW techniques. Single-piece door with inner and outer door panels shall have a combined steel thickness of no less than [0.096] inches thick. Welded door design with inner panel optimizes structural integrity of locker door system over and above any single frame door design.
2. Exterior door panel shall be constructed with formed flanges and return flanges to add stiffness.

3. Internal door panel shall be constructed with formed flanges for added stiffness.
4. All inner door panel (except Multi-Tier) heights shall be minimum 70% of external door height.
5. Single-piece welded door frame shall consist of internal door panel nested inside exterior door panel and welded per the following requirements:
    a. Top / bottom. Exterior and Interior panels to be welded in a minimum of three (3) places with weld spacing not to exceed [6] inches between adjacent welds and [1] inch from any corner.
    b. Sides. Exterior and interior panels to be welded with spacing not to exceed [12] inches between adjacent welds and [1] inch from any corner.
6. Inner door panel to have peg board style hole pattern, allowing the attachment of Document Holder and any standard peg board accessory.
7. Inner door panel to have [4] inch rectangular slot centered towards the top of the locker.
8. External door panel shall have louvers to provide adequate air circulation throughout locker system.
    a. Louvered air vents shall be located at the bottom of the locker door to enhance circulation of mechanically extracted air from the bottom of the locker out of the top.
    b. Louvered air vents shall be approximately [3] inches in width and [0.75] inches or in height and spaced on [1] inch centers.
9. Single door designs available in: Reference drawings.
10. All doors shall have neoprene silencers on each door for noise reduction
11. Door torsional deflection shall not exceed [0.1875] inch with a [20] lb point load. (Test data to be provided by manufacturer upon request)
12. Hinge:
    a. Provide 16-gauge full length hinge for increased strength and security of locker system.
    b. Hinges to be welded to door frame with spot welds not to exceed [6] inch separation.
13. Door assembly to be riveted to door frame on factory pre-established hole pattern.
14. Locking Mechanism.
    a. Provide three locking options (all locking options have protective stainless steel cover plate for durability and scratch resistance):
        1) Padlock hasp only.

G. Interior/Accessory components (Architect/Owner to specify):

1. All interior components must be constructed of minimum 18-gauge steel (unless otherwise clarified in specification).
2. For added security, internal component can be secured utilizing blind rivets, threaded fasteners, or bending specially designed tab.
3. All interior components available at time of order and as post-installation upgrades in the future.
4. Shelves (available all locker models)
    a. Shelf with integral hanger bracket
        1) Size specified by locker width
        2) Hanger bracket designed with perforations on approximately [3] inch centers to insure clothing separation for optimum ventilation
        3) Performance: Uniform load rating [300] lbs

H. Electrical system
1. UL listed manufactured electrical wiring system with plug-in-play component design
2. Receptacles – standard 20 amp duplex receptacles and 20 amp GFCI duplex receptacles

I. Locker Tag Numbers
1. Shall provide locker numbers on each locker per customer requirement

J. ACCESSORIES:
1. Trim and Fillers: Provide manufacturer's standard.
2. Continuous Sloped Top. Provide manufacturers standard.

2.5 FABRICATION

A. General: Coordinate fabrication and delivery to ensure no delay in progress of the work.

2.6 FINISHES

A. Colors: Selected from manufacturer's standard available colors

B. Paint Finish: Textured (Standard) – Provide factory applied electrostatic powder coat paint. Meet or exceed specifications of the American Society for Testing and Materials (ASTM) Standards:

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Lockers scheduled to receive accessories [with Installer present] for compliance with requirements for installation tolerances and other conditions affecting performance of specified accessory items.

B. Proceed with accessory installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Follow manufacturer's written instructions for installation of each type of accessory item specified.

3.3 FIELD QUALITY CONTROL

A. Verify accessory unit alignment and plumb after installation. Correct if required, following manufacturer's instructions.

B. Remove components that are chipped, scratched, or otherwise damaged and which do not match adjoining work. Replace with new matching units, installed as specified and in manner to eliminate evidence of replacement.

3.4 ADJUSTING

A. Adjust all accessories to provide smoothly operating, visually acceptable installation.

3.5 CLEANING

A. Immediately upon completion of installation, clean components and surfaces. Remove surplus materials, rubbish and debris, resulting from installation, upon completion of work and leave areas of installation in neat, clean condition.

3.6 DEMONSTRATION/TRAINING

A. Schedule and conduct demonstration of installed accessory items and features with Owner's personnel.

B. Schedule and conduct maintenance training with Owner's maintenance personnel. Training session should include lecture and demonstration of all maintenance and repair procedures that end-user personnel would normally perform.

3.7 PROTECTION

A. Protect system against damage during remainder of construction period. Advise owner of additional protection needed to ensure that system will be without damage or deterioration at time of substantial completion.

END OF SECTION 10.5113

SECTION 10.7500 - FLAGPOLES

PART 1 - GENERAL

1.1 STIPULATIONS

The specifications sections “General Conditions of Contract”, “Special Conditions” and “Division 1 – General Requirements” form a part of this section by this reference thereto, and shall have the same force and effect as if printed herewith in full.

1.2 SUMMARY

A. Sections includes flagpoles and accessories.

B. Related Requirements:

1. Section 03 30 00 – Cast-in-Place Concrete: Flagpole base concrete.

1.3 REFERENCE STANDARDS

A. ASTM International:

1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM A312/A312M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes.
4. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
5. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.

B. Copper Development Association Inc.:

1. CDA – Copper Brass Bronze Design Handbook: Architectural Applications.

1.4 PERFORMANCE REQUIREMENTS

A. Flagpole with Flag Flying: Resistant without permanent deformation to 45 miles/hr wind velocity; non-resonant, safety design factor of 2.5.

B. Flagpole without Flag: Resistant without permanent deformation to 70 miles/hr wind velocity; non-resonant, safety design factor of 2.5.

1.5 SUBMITTALS

A. Shop Drawings: Indicate detailed dimensions, base, attachment details, anchor requirements, and imposed loads. Provide professional engineers design for all structural components including foundation.

B. Product Data: Submit data on pole, accessories, and configurations.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit Operation and Maintenance Data.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with Commonwealth of Pennsylvania standards.

1.8 QUALIFICATIONS

A. Design flagpole, foundation, and supports under direct supervision of Professional Engineer experienced in design of this Work and licensed in Commonwealth of Pennsylvania.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.

B. Protect flagpole and accessories from damage or moisture.

PART 2 - PRODUCTS

2.1 FLAGPOLES

A. Manufacturers:

1. Eder Flag Manufacturing Company, Inc.
   a. One (1) Federal Flagpole: Model EC50IH, 50’ Exposed Height, 3 Section, Internal Halyard

B. Product Description: Aluminum Flagpole, fabricated from seamless 6063-T6 aluminum tubing with tensile strength not less than 30,000 psi with yield point of 25,000 psi. Heat treated after fabrication to comply with ASTM B 597, temper T-6

C. Finish: Highly polished with fine grain aluminum oxide cloth Satin finish

2.2 COMPONENTS

A. Outside Butt Diameter:

1. Model EC50: 10"

B. Outside Top Diameter:

1. Model EC50: 4""

C. Nominal Wall Thickness:

1. Model EC50: .188"

D. Exposed Height:

1. Model EC50: 50'

E. Flagpole: Ground set, including foundation sleeve, stainless steel cable assembly, Winch system, Winch Handle, and two (4-3/4") stainless steel swivel snap hooks. Finishes to match flagpole.

F. Flagpole Design: Cone tapered.

G. Halyard: Internal.

2.3 ACCESSORIES

A. Finial Ball:

1. Flagpole Model EC50: Model SB110, Aluminum, 10" diameter, Gold Anodized

B. Flag: (American Flag)

1. Flagpole Model EC50: 10' x 15' size, Nylon fabric, brass grommets, hemmed edges

C. Winch Lock:

1. Winch Lock and four (4) keys.

D. Flash Collar:

1. High Profile "Trumpet" Aluminum Flash Collar – Satin Finish

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify concrete foundation is ready to receive work and dimensions are as indicated on shop drawings.

3.2 INSTALLATION

A. Section 03 30 00 – Cast-in-Place Concrete: Fill foundation tube sleeve with concrete.

B. Install steel foundation plate, grounding spike, and centering wedges for flagpoles base set in concrete base and fasten.

3.3 ERECTION TOLERANCES

A. Maximum Variation From Plumb: 1/2 inch

3.4 ADJUSTING

A. Adjust operating devices so halyard and flag function smoothly.

END OF SECTION 10 75 00

SECTION 10.7516 – FLAGPOLE

PART 1 - GENERAL

1.01 SECTION DESCRIPTION

A. The Work of This Section Includes:

1. Furnish and install an aluminum flagpole with flag in accordance with the requirements of this Section and where shown on the Drawings. Flag shall be provided along with the pole.

1.02 QUALITY ASSURANCE

A. Reference Standards:

1. American Society for Testing and Materials (ASTM):

B241 Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.

B. Manufacturing Standards:

1. Provide each flag pole as a complete unit produced by a single manufacturer, including fittings, accessories and anchorage devices.

C. Design Criteria:

1. 40’ flagpole and installation method constructed to withstand a 171 mph wind unflagged and a wind velocity of 117 mph when flying a 8’ x 12’ flag.
2. 30’ flagpole and installation method constructed to withstand a 184 mph wind unflagged and a wind velocity of 117 mph when flying a 5’ x 8’ flag.

D. Pole Construction:

1. Construct pole and ship to site in one (1) piece if possible. If more than one (1) piece is required, provide precise joints with self aligning, internal splicing sleeve arrangement.

1.03 SUBMITTALS

A. Manufacturers Literature:

1. Submit manufacturer's descriptive literature for the following items in accordance with Section 01 33 00:

- Flagpole
- Ground Sleeve
- Fittings and accessories

B. Shop Drawings

1. Submit detail shop drawings of the flagpole and complete anchoring and supporting system in accordance with Section 01 33 00.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with the requirements set forth in Section 01 60 00 of these specifications relative to transportation and handling along with storage and protection.

B. Deliver materials to the job site in good condition and properly protected against damage to finished surfaces. Spiral wrap flagpole with heavy kraft paper or other protective wrapping and ship in hard fiber tube or other protective enclosure. Exercise care when off-loading material to prevent damage.

C. Storage on site

1. Store material in a location and in a manner to avoid damage. Stacking shall be done in a way which will prevent bending.

2. Store aluminum, components and materials in clean, dry location, away from uncured concrete and masonry. Cover with waterproof paper, tarpaulin or polyethylene sheeting in a manner that will permit circulation of air inside the covering.

D. Keep handling on site to a minimum. Exercise particular care to avoid damage to finishes of materials.

E. In the event of any damage to the material, however slight, Contractor shall notify the Resident Project Representative at once and shall repair or replace the material in a manner satisfactory to Owner.

PART 2 - PRODUCTS

2.01 FLAGPOLE SYSTEM

A. Flagpole Shaft

1. Commercial grade aluminum construction fabricated from seamless extruded tubing, complying with ASTM B241, 6063-T6 aluminum alloy having a tensile strength of not less than 30,000 psi and a yield point of 25,000 psi. Heat treat and age harden after fabrication.

2. Finish shall be deep luster finish, fine, directional mechanical 100 grit polish (NAAMM-32)

3. Description:

a. 30’ Pole:
- Exposed height: 30’
- Butt diameter: 6” minimum at base, tapered to 3 ½” top.
- Wall thickness: 0.156” at base minimum

b. 40’ Pole:
- Exposed height: 40’
- Butt diameter: 8” minimum at base, tapered to 3 ½” top.
- Wall thickness: 0.156” at base minimum

B. Mounting

1. Standard embedded system including ground sleeve fabricated from 16 gauge galvanized steel with steel base plate and steel support plate and ground spike at least 3/4” diameter and 18” long.

C. Fittings

1. Flagpole have an internal halyard and shall be equipped with:
   a. Single sheave truck, cast aluminum revolving, non-fouling, internal halyard truck.
   b. Gearless, self-locking direct drive winch with six tumbler cylinder lock

2. Spun Aluminum Flash Collar with diameter at least 1” greater than diameter of ground sleeve.

D. Acceptable Manufacturer

1. Liberty Flagpoles or approved equivalent.

PART 3 - EXECUTION

3.01 GENERAL

1. Review location of flagpole for overhead and buried utilities, including electrical and natural gas lines, which pose situations requiring extreme care during installation of foundation and flagpole.

3.02 INSTALLATION OF FOUNDATION

1. Dig hole for foundation of the approximate size and exact location as shown on the Drawings.

2. Set ground sleeve slightly above finish grade level and plumb in center of hole.

3. Pour minimum PennDOT Class AA concrete around outside of ground sleeve making sure sleeve remains in center and plumb.

4. Cover sleeve opening to prevent entry of debris and water.

3.03 INSTALLATION OF FLAGPOLE

1. Install flagpole in compliance with approved submittal and manufacturer’s instructions.

2. Paint portions of flagpole below grade with a heavy coat of bituminous paint.

END OF SECTION

SECTION 12.2400 - WINDOW SHADES

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Opaque window shade system: Manually operated, roll-up fabric opaque window shade system for complete blackout of window opening including side and bottom channels, headbox, manual operator, and mounting hardware.
B. Opaque window shade system: Motorized, roll-up fabric interior window shades including motor operator, controls, and mounting hardware

1.2 RELATED SECTIONS

A. Section 06 10 53 - Rough Carpentry
B. Section 09 29 00 - Gypsum Board
C. Section 09 50 00 - Acoustical Ceilings
D. Division 26 - Electrical: Electrical supply, conduit, and wiring for motorized window shades

1.3 REFERENCES

A. NFPA 70 - National Electrical Code
B. NFPA 701-99 - Fire Tests for Flame-Resistant Textiles and Films

1.4 SUBMITTALS

A. Submit under provisions of Section 01.3326 - Source Quality Control Reporting:

B. Product Data: Manufacturer's data sheets on each product specified, including:

1. Preparation instructions and recommendations.
2. Installation and maintenance instructions.
3. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.
4. Storage and handling requirements and recommendations.
5. Mounting details and installation methods.
6. Typical wiring diagrams including integration of motor controllers with building management system, audiovisual and lighting control systems as applicable.

C. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams and relationship to adjacent work.

D. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings, field verified window dimensions, quantities, type of shade, controls, fabric, and color, and include opening sizes and key to typical mounting details.

E. Selection Samples: For each finish product specified, two complete sets of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns.

F. Verification Samples: For each finish product specified, two complete sets of shade components, unassembled, demonstrating compliance with specified requirements. Shade fabric sample and aluminum finish sample as selected, representing actual product, color, and patterns. Mark face of material to indicate interior faces.

G. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.

H. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of twenty years' experience in manufacturing products comparable to those specified in this section.

B. NFPA Flame-Test: Passes NFPA 701. Materials tested shall be identical to products proposed for use.

C. Mock-Up: Provide a mock-up of one of each type roller shade assembly specified for evaluation of mounting, appearance and accessories.

1. Locate mock-up in window(s) designated by Architect.
2. Do not proceed with remaining work until mock-up is accepted by Architect.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver window shades until building is enclosed and construction within spaces where shades will be installed is substantially complete.

B. Deliver products in manufacturer's original, unopened, undamaged containers with labels intact.

C. Label containers and shades according to Window Shade Schedule.

D. Store products in manufacturer's unopened packaging until ready for installation.

1.7 SEQUENCING

A. Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.

B. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.8 PROJECT CONDITIONS

A. Install roller shades after finish work and ambient temperature, humidity and ventilation conditions are maintained at levels recommended for project upon completion.

1.9 WARRANTY

A. Hardware and Shade Fabric: Draper's standard twenty-five year limited warranty.
B. Spring Roller Shades: Draper's standard ten year limited warranty.
C. Motors and Controls: Draper's standard five year limited warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Draper, Inc., which is located at: 411 S. Pearl P. O. Box 425 ; Spiceland, IN 47385-0425; Toll Free Tel: 800-238-7999; Tel: 765-987-7999; Email:request info; Web:www.draperinc.com

B. Approved Equals: Hunter Douglas, MechoShade and Lutron.

C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

2.2 MANUALLY OPERATED WINDOW SHADES

A. Manually Operated Window Shades with Independent Control: Manually operated, vertical

roll-up, fabric window shade with components necessary for complete installation; Manual FlexShade as manufactured by Draper, Inc.

1. Operation: Bead chain and clutch operating mechanism allowing shade to stop when chain is released. Designed never to need adjustment or lubrication. Provide limit stops to prevent shade from being raised or lowered too far.
    a. Clutch mechanism: Fabricated from high carbon steel and molded fiberglass reinforced polyester or injected molded nylon. White or Black color as selected by Architect.
    b. Bead chain loop: Stainless steel bead chain hanging at side of window.
    c. Idler Assembly: Provide roller idler assembly of molded nylon with adjustable or spring-loaded length idler pin to facilitate easy installation, and removal of shade for service.
    d. Bead Chain Hold Down: Spring-Loaded Tensioner complies with ANSI/WCMA A100.1-2018 safety standard.

2. Roller Tube: Fabricated from extruded aluminum, galvanized steel, or enameled steel. Diameter, wall thickness, and material selected by manufacturer to accommodate shade type and size. Fabric connected to the roller tube with LSE (low surface energy) double sided adhesive specifically developed to attach coated textiles to metal. Adhesive attachment to eliminate horizontal impressions in fabric.
3. Bottom Slat
    a. Closed pocket elliptical slat: 1" (25mm) aluminum elliptical slat inside of a 1 5/8" (41mm) pocket with heat sealed ends
4. Mounting:
    a. Mounting brackets.
    b. Endcaps and fascia.
    c. Endcaps and headbox.
5. Brackets: Plated stamped steel. Provide size compatible with roller size.
    a. Mounted to jamb.
6. Endcaps: Stamped steel with universal design suitable for mounting to ceiling, wall, and jamb. Provide size compatible with roller size.
    a. Endcap covers: To match fascia or headbox color.
7. Headbox Ceiling/Wall style: Aluminum fabrication with removable closure, endcaps, and back and top cover piece:
    a. Finish: Custom powder coat as selected by the Architect.

2.3 MOTORIZED WINODW SHADES

A. Type: UL listed, motorized, vertical roll-up, fabric window shade with motors, controls, mounting brackets, and other components necessary for complete installation; Motorized FlexShade AC as manufactured by Draper, Inc.

1. Endcaps and ceiling/wall headbox.

B. Shade Motor and Control System
   1. Motorized FlexShade AC
      a. Standard Motor: 120V AC, single phase, 60 HZ, instantly reversible, lifetime lubricated, and equipped with internal thermal overload protector, electric brake, and pre-set accessible limit switches. Tubular motor concealed inside each shade roller tube.
         1) Wall Switch – Key operated three position wall switch.
      b. Individual and Group Control: IGC4N1. Individual and Group control of up to four motors with up to three intermediate positions per motor.

C. Configuration:
   1. Single Roller.
      a. Mounting.
         1) Headbox Ceiling/Wall Style: Aluminum fabrication with removable closure, endcaps, and back and top cover piece:
            a) Finish: Custom powder coat as selected by the Architect.

D. Shade slat:
   1. Closed pocket elliptical slat: 1 inch (25 mm) aluminum elliptical slat inside of a 1-5/8 inch (41 mm) pocket with heat sealed ends.

E. Roller: Fabricated from extruded aluminum or steel. Wall thickness and material selected by manufacturer to accommodate shade size. Provide with roller idler assembly of molded nylon and zinc-plated steel pin. Sliding pin to allow easy installation and removal of roller. Fabric connected to the roller tube with LSE (low surface energy) double sided adhesive specifically developed to attach coated textiles to metal. Adhesive attachment to eliminate horizontal impressions in fabric.

2.4 FABRIC

A. Room Darkening Fabrics
   1. Flocké by Mermet, as supplied by Draper, Inc.: Opaque, light-blocking fiberglass textile with acrylic coating and cotton flocked backing; composition of 42 percent fiberglass, 51 percent acrylic, and 7 percent cotton; 0 percent openness. Fire performance: NFPA 701, Test Method 1. Nominal weight: 15.93 oz./sq. yd.; nominal thickness: 0.020 inch, each with manufacturer's tolerance of ±10 percent. Color: As selected by Architect from manufacturer's full range.

B. Standard Shade Fabric:
   1. E Screen 3% by Mermet, as supplied by Draper, Inc.: PVC-coated fiberglass yarn

woven in a 2 by 2 basketweave; composition of 36 percent fiberglass and 64 percent vinyl; 3 percent openness. Fire performance: NFPA 701. Nominal weight: 11.6 oz./sq. yd.; nominal thickness: 0.017 inch, each with manufacturer's tolerance of ±5 percent. Color: Pearl/Grey

PART 3 – EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. A. Coordinate requirements for blocking and structural supports to ensure adequate means for installation of window shades.

B. Coordinate requirements for blocking, construction of shade pockets, and structural supports to ensure adequate means for installation of window shades.

C. Coordinate installation of recessed shade pockets with construction of suspended acoustical panel ceilings specified in Section 09.5000.+

D. Coordinate installation of recessed shade pockets with construction of suspended gypsum board ceilings specified in Section 09.2900.

E. Coordinate requirements for power supply conduit, and wiring required for window shade motors and controls.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install roller shades level, plumb, square, and true. Allow proper clearances for window operation hardware.

C. Shade pockets:

1. Install shade pockets prior to installation of suspended ceiling system. Attach to supporting structure with screws through top of pocket at 24 inches (610 mm) minimum centers.
2. Install shade pockets in conjunction with installation of suspended ceiling system. Attach to supporting structure with screws through top of pocket at 24 inches (610 mm) minimum centers.
3. Install corner pieces securely and in alignment with pockets.
4. Install pocket ends securely and in alignment with pockets.
5. After interior construction is essentially complete, install shade and operating mechanism in pocket.
6. Install the following items to conceal roller and operating mechanism. Do not use exposed fasteners.
    a. Fascias
    b. Closure panels
    c. Endcaps

D. Install headbox, side channels, and sill channel with sealant specified in Section 07 90 00 - Joint Protection.

E. Position shades level, plumb, and at proper height relative to adjacent construction. Secure with fasteners recommended by manufacturer.

3.4 TESTING AND DEMONSTRATION

A. Test motorized window shades to verify that controls, limit switches, interface to other building systems, and other operating components are functional. Correct deficiencies.

B. Test window shades to verify that operating mechanism, fabric retainer, and other operating components are functional. Correct deficiencies.
    1. Chain and clutch.

C. During daylight hours, lower shades and turn off interior lights. Verify that there are no light leaks at perimeter or within shade assembly. Correct deficiencies.

D. Demonstrate operation of shades to Owner's designated representatives.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

3.6 SCHEDULES

A. Refer to Drawings for shade types and locations.

END OF SECTION 12.2400

SECTION 12.3200 - MANUFACTURED CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Plastic-laminate-faced wood cabinets of stock design.
   2. Plastic-laminate countertops- custom.
   3. Quartz Countertops
   4. Stainless Steel Countertops.

B. Related Sections include the following:
   1. Division 06 Section "Rough Carpentry" for wood blocking for anchoring manufactured wood casework.
   2. Division 06 Section "Architectural Woodwork."
   3. Division 09 Section "Resilient Base and Accessories" for resilient base applied to manufactured wood casework.

1.3 DEFINITIONS

A. MDF: Medium-density fiberboard.

B. Exposed Portions of Cabinets: Surfaces visible when doors and drawers are closed, including bottoms of cabinets more than 48 inches above floor, and surfaces visible in open cabinets.

C. Semi-exposed Portions of Cabinets: Surfaces behind opaque doors, such as interiors of cabinets, shelves, dividers, interiors and sides of drawers, and interior faces of doors. Tops of cases 78 inches or more above floor are defined as semi-exposed.

D. Concealed Portions of Cabinets: Surfaces not usually visible after installation, including sleepers, web frames, dust panels, and ends and backs that are placed directly against walls or other cabinets.

E. Hardwood Plywood: A panel product composed of layers or plies of veneer, or of veneers in combination with lumber core, hardboard core, MDF core, or particleboard core, joined with adhesive, and faced both front and back with hardwood veneers.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show fabrication details, including types and locations of hardware. Show installation details, including field joints and filler panels. Indicate manufacturer's catalog numbers for casework.

C. Samples for Verification: Accompanying the Shop Drawings, submit Samples of pulls, full range of standard high pressure laminate colors, and full range of standard PVC edging colors for selections by the Architect.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain manufactured wood casework from single source from single manufacturer.

B. Product Designations: Drawings indicate sizes, configurations, and finish material of manufactured wood casework by referencing designated manufacturer's catalog numbers. Other manufacturers' casework of similar sizes and door and drawer configurations, of same finish material, and complying with the Specifications may be considered.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver manufactured wood casework only after painting, utility roughing-in, and similar operations that could damage, soil, or deteriorate casework have been completed in installation areas. If casework must be stored in other than installation areas, store only in areas where environmental conditions meet requirements specified in 1.7 "Project Conditions" below.

B. Keep finished surfaces covered with polyethylene film or other protective covering during handling and installation.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install manufactured wood casework until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify actual dimensions of construction contiguous with manufactured wood casework by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate layout and installation of framing and reinforcements in walls and partitions for support of manufactured wood casework.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of manufactured wood casework that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Delamination of components or other failures of glue bond.
b. Warping of components.
c. Failure of operating hardware.
d. Deterioration of finishes.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Stevens Advantage. or comparable product by one of the following: (Drawings indicate product numbers of Case Systems Inc.)

1. Plastic-Laminate-Faced Manufactured Casework:
a. Mastercraft Woodworking Company, Inc.
b. Case Systems Inc

2.2 MATERIALS, GENERAL

A. Maximum Moisture Content for Lumber: 7 percent for hardwood and 12 percent for softwood.

B. Hardwood Plywood: HPVA HP-1, either veneer core or particleboard core unless otherwise indicated.

C. Softwood Plywood: DOC PS 1.

D. Hardboard: AHA A135.4, Class 1 Tempered.

E. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. ARBORITE – Basis of Design.
   b. Nevamar Company, LLC; Decorative Products Div.
   c. Wilsonart International; Div. of Premark International, Inc.
2. Edgebanding for Plastic Laminate: Rigid PVC extrusions, through color with satin finish, 3 mm thick at doors and drawer fronts, 1 mm thick elsewhere.

F. Quartz Surfacing: Polyester resin binder and pigments with 90-93% crushed quartz aggregates.
1. Manufacturers:
   a. Viatera:
      1) Contact: 1-610-256-8703
   b. Silestone (by Cosentino Group)
      1) 1401 W. Morehead St., Charlotte, NC 28208
      2) Phone: 877-978-2789
      3) sales@caesarstoneus.com
2. Thickness: 2 cm or as indicated on the drawings.
3. Finish: Polished
4. Performance:
   a. Water Absorption: ≤ 0.05% (ASTM C97)
   b. Flexural Strength: ≥ 6,000 psi.
   c. Flame Spread Index: ≤ 25 (ASTM E84).
5. Color and Pattern: As selected by the Architect from manufacturer's full range of premium colors.

G. Stainless Steel Countertops: Factory-fabricated stainless steel countertops, backsplashes, WATERFALL EDGES, integral sinks, and related trim.
1. Manufacturers:
   a. Stainless Supply, Monroe, NC, stainlesssupply.com/stainless-kitchen-products
   b. Commercial Stainless, Inc., Phone: (570) 387-8980, Fax: (570) 387-8982, commercialstainless.com.
   c. Great Lakes Stainless, Traverse City, MI, Phone: 231-943-7648, info@greatlakesstainless.com
   d. Stainless Steel Fabricators, Inc., Raleigh, NC, Email: mail@berlinusa.com
2. Materials:
   a. Stainless Steel Sheet:
      1. Type: ASTM A240, Type 316
      2. Finish: No. 4 Satin (directional brushed finish) unless otherwise indicated.
      3. Thickness: Minimum 14 gauge (0.075 in) for countertops; 18 gauge (0.050 in) for vertical risers and backsplashes.
3. Substrate:
   a. Marine-grade plywood or moisture-resistant core per manufacturer's recommendation.
4. Edge Profile:

a. Square, marine, or rolled edge, as indicated on drawings.

5. Sinks: As selected by the Architect.
6. Accessories:
   a. Adhesives, sealants, and mounting hardware as recommended by fabricator and compatible with stainless steel.

H. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, suitable for exposed applications.

I. Label Holders: Where shown or called for, shall be self-adhesive type aluminum with satin finish and designed for 2-1/2" x 1-1/8" cards, unless otherwise specified.

J. Number Plates: Where shown or called for, shall be self-adhesive type aluminum with indented black lettering.

2.3 CABINET MATERIALS

A. Exposed Cabinet Materials:
   1. Plastic Laminate:
      a. Grade HGS in general offices, conference rooms, etc.
      b. Grade CHEM in all labs and workrooms not scheduled for other types of countertops.
   2. Unless otherwise indicated, provide specified edgebanding on all exposed edges.

B. Semiexposed Cabinet Materials:
   1. Plastic Laminate: Grade VGS.
      a. Provide plastic laminate for semiexposed surfaces unless otherwise indicated.
      b. Provide plastic laminate for interior faces of doors and drawer fronts and where indicated.
   2. Metal for Steel Drawer Pans: Cold-rolled, steel sheet.
   3. Unless otherwise indicated, provide specified edgebanding on all semiexposed edges.

C. Concealed Cabinet Materials:
   1. Solid Wood: Any hardwood or softwood species, with no defects affecting strength or utility.
   2. Plywood: Hardwood plywood. Provide backs of same species as faces.
   3. Plastic Laminate: Grade BKL.

2.4 DESIGN, COLOR, AND FINISH

A. Design: Provide manufactured wood casework of the following design:
   1. Heavy Duty Stainless Steel wire pulls, ADA compliant.

B. Plastic-Laminate Colors, Patterns, and Finishes: As selected by Architect from plastic-laminate manufacturer's full range of colors and patterns

C. PVC Edgebanding Color: As selected from casework manufacturer's full range.

2.5 CABINET FABRICATION

A. Plastic-Laminate-Faced Cabinet Construction: As required by referenced quality standard, but not less than the following:

1. Bottoms and Ends of Cabinets, and Tops of Wall Cabinets and Tall Cabinets: 3/4-inch plywood, plastic-laminate faced on exposed surfaces, thermoset decorative panels on semiexposed surfaces. Solid sub top.
2. Shelves: 3/4-inch plywood to 27 inches wide, 1 inch thick over 27 inches wide and at open cabinets, reversible, edged on front only.
3. Backs of Cabinets: 1/2-inch plywood, plastic-laminate faced
4. Base Cabinet Sub-tops: 3/4-inch plywood panel product glued and pinned or screwed
5. Drawer Fronts: 3/4-inch hardwood, plastic-laminate faced.
6. Drawer Sides and Backs: 1/2-inch solid-wood or veneer-core hardwood plywood, with glued dovetail or multiple-dowel joints.
7. Drawer Bottoms: 1/4-inch hardwood plywood glued and dadoed into front, back, and sides of drawers.
8. Doors: 3/4-inch plywood, plastic-laminate faced.

B. Filler Strips: Provide as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as cabinets.

C. Fabricate design to comply with the requirements of the American with Disabilities Handbook – EEOC-BK-19, dated October 1992, and Appendix B-ADA Accessibility Guidelines, except where the height of cabinets is noted otherwise on the Drawings.

2.6 CASEWORK HARDWARE AND ACCESSORIES

A. Hardware, General: Unless otherwise indicated, provide manufacturer's standard commercial-quality, heavy-duty hardware.

1. Use threaded metal or plastic inserts with machine screws for fastening to particleboard except where hardware is through-bolted from back side.

B. Butt Hinges: Powder-coated, chrome finish, semi-concealed, 5-knuckle hinges complying with BHMA A156.9, Grade 1, with antifriction bearings and rounded tips. Provide 2 hinges for doors less than 48 inches high and 3 hinges for doors more than 48 inches high.

C. Frameless Concealed Hinges (European Type): BHMA A156.9, Type B01602, 170 degrees of opening, self-closing.

D. Pulls: Solid stainless steel wire pulls, with clear anodized finish, fastened from back with two screws. For sliding doors, provide recessed chrome-plated flush pulls. Provide 2 pulls for drawers more than 24 inches wide.

E. Door Catches: Powder-coated dual, self-aligning, permanent magnet catch. Provide 2 catches on doors more than 48 inches high.

F. Drawer Slides: BHMA A156.9, Type B05091.

1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated, steel ball-bearing slides.

G. Label Holders: Chrome plated, sized to receive standard label cards approximately 1 by 2 inches, attached with screws or brads.

1. Provide label holders where indicated.

H. Drawer and Hinged Door Locks: Cam type, 5-pin tumbler, brass with chrome-plated finish, and complying with BHMA A156.11, Grade 1.

1. Provide a minimum of two keys per lock and six master keys.
2. Provide locks on all doors and drawers. Key locks alike in each room and master keyed throughout the building.
3. Digital Evidence Cabinet shall be keyed as indicated on the Drawings.

I. Adjustable Shelf Supports: 2-pin locking plastic shelf rests complying with BHMA A156.9, Type B04013, 300 pound load rating per support.

J. Grommets for Cable Passage through Countertops: 2-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage.

2.7 COUNTERTOPS

A. Countertops, General: Provide countertops as one continuous piece wherever possible. Minimize seams to greatest extent possible. Provide smooth, clean exposed tops and edges in uniform plane free of defects. Provide front and end overhang of 1 inch over base cabinets.

B. Plastic-Laminate Tops: Plastic-laminate sheet, shop bonded to both sides of 1 inch thick plywood. Sand surfaces to which plastic laminate is to be bonded.

1. Plastic Laminate for Flat Tops: Grade HGS, 0.050 inch thick
2. Plastic Laminate for Flat Tops in Labs: Grade CHEM, 0.050 inch thick
3. Plastic Laminate for Backing: Grade BKL.
4. Provide plastic-laminate edgings of the same material as top on front edge of top, on top edges of backsplashes and end splashes, and on ends of tops and splashes.

C. Quartz Tops, General: Provide countertops as one continuous piece wherever possible. Minimize seams to greatest extent possible. Provide smooth, clean exposed tops and edges in uniform plane free of defects. Provide front and end overhang of 1 inch over base cabinets.

D. Stainless Steel Countertops, General: Provide countertops as one continuous piece wherever possible. Minimize seams to greatest extent possible. Provide smooth, clean exposed tops and edges in uniform plane free of defects. Provide front and end overhang of 1 inch over base cabinets

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, and other conditions affecting performance of manufactured wood casework.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPERATION

A. Coordinate with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. Plumbing Contractor will furnish templates for all cut-outs in countertops and cabinets where sinks and associated items will be installed.

C. Take necessary measurements in the field to assure proper fit of shop fabricated items.

D. Prior to start of installation verify that the work of other trades is sufficiently complete to properly permit this installation to proceed.

3.3 CASEWORK INSTALLATION

A. Install level, plumb, and true; shim as required, using concealed shims. Where manufactured wood casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.

B. Base Cabinets: Set cabinets straight, level, and plumb. Adjust subtops within 1/16 inch of a single plane. Fasten cabinets to masonry or framing, wood blocking, or reinforcements in walls and partitions with fasteners spaced 24 inches o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of 1/16 inch.

1. Where base cabinets are not installed adjacent to walls, fasten to floor at toe space with fasteners spaced 16 inches o.c. Secure sides of cabinets to floor, where they do not adjoin other cabinets, with not less than two fasteners.

C. Wall Cabinets: Hang cabinets straight, level, and plumb. Adjust fronts and bottoms within 1/16 inch of a single plane. Fasten to hanging strips, masonry, or framing, blocking, or reinforcements in walls or partitions. Align similar adjoining doors to a tolerance of 1/16 inch.

1. Fasten through back, near top and bottom, at ends, and not more than 16 inches o.c.
2. Use toggle bolts at hollow masonry.
3. Use expansion anchors at solid masonry.
4. Use No. 10 wafer-head screws sized for 1-inch penetration at wood hanging strips.
5. Use No. 10 wafer-head screws sized for 1-inch penetration into wood framing or blocking at wood-framed partitions.
6. Use No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish at metal-framed partitions.
7. Use toggle bolts at plaster on metal lath.

D. Install hardware uniformly and precisely. Set hinges snug and flat in mortises unless otherwise indicated. Adjust and align hardware so moving parts operate freely and contact points meet accurately. Allow for final adjustment after installation.

E. Adjust casework and hardware so doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.4 INSTALLATION OF TOPS

A. Field Jointing: Where possible make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.

1. Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

B. Support countertops uniformly with full bearing; secure in place with manufacturer’s approved adhesives.

C. Provide tight, flush, hairline joints.

D. Secure tops to cabinets with Z- or L-type fasteners or equivalent, using two or more fasteners at each front, end, and back.

E. Abut top and edge surfaces in one true plane, with internal supports placed to prevent deflection. Secure backsplashes and end splashes to walls with adhesive.

F. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.5 ADJUSTING

A. Adjust casework and hardware so doors and drawers are centered in openings and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

B. Inspect completed installation for damage, gaps, and alignment. Replace defective work.

3.6 CLEANING AND PROTECTING

A. Repair or remove and replace defective work as directed on completion of installation.

B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

C. Protection: Provide 6-mil plastic or other suitable water-resistant covering over countertop surfaces. Tape to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION 12.3200

SECTION 12.3600 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Solid surface material countertops.
2. Solid surface material backsplashes.
3. Solid surface material end splashes.
4. Solid surface material apron fronts.

B. Related Requirements:

1. Division 22 " Plumbing " for and plumbing fittings.

1.3 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.
3. Details shall be produced in 1/2-inch scale minimum for all fabricated items

C. Samples for Verification: For the following products:

1. Countertop material, 6 inches square.
2. Wood trim, 8 inches long.
3. One full-size solid surface material countertop, with front edge and backsplash, 8 by 10 inches, of construction and in configuration specified.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

C. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and execution.

1. Build mockup of typical countertop as shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.8 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver no components to project site until areas are ready for installation

B. Store components indoors prior to installation.

C. Handle materials to prevent damage to finished surfaces.

1. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.10 WARRANTY

A. Provide manufacturer’s warranty against defects in materials.

1. Warranty shall provide material and labor to repair or replace defective materials.
2. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.
3. Warranty shall be transferable to subsequent owner for remainder of warranty period.

B. Manufacturer's warranty period

1. Ten years from date of substantial completion

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS – **SS-01 & SS-02**

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. LG Hausys Hi-Macs
   b. Wilsonart LLC.
   c. Nevamar
2. Basis of design:
   a. As indicated on drawings – Design Summary Selection
3. Type: Provide Standard unless Special Purpose type is indicated.
4. Integral Sink Bowls: Comply with CSA B45.5/IAPMO Z124.
5. Colors and Patterns: as per drawings.

B. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.

C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 COUNTERTOP FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Premium .

B. Countertops: 1/2-inch- thick, solid surface material with front edge built up with same material.

C. Backsplashes: 1/2-inch- thick, solid surface material.

D. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.

E. Joints: Fabricate countertops in sections for joining in field.

1. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.
2. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints. Make width of cuts slightly more than thickness of splines to provide snug fit. Provide at least three splines in each joint.

F. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
   a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

1. Verify adhesives have a VOC content of 70 g/L or less.
2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.

C. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

1. Install metal splines in kerfs in countertop edges at joints. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

E. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

F. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

1. Seal edges of cutouts in particleboard subtops by saturating with varnish.

H. Apply sealant to gaps at walls; comply with Section 07.9200 "Joint Sealants."

END OF SECTION 12.3600

SECTION 12.3661.19 - QUARTZ SURFACING COUNTERTOPS & SILLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Quartz agglomerate surfacing countertops.
2. Quartz agglomerate backsplashes.
3. Quartz agglomerate end splashes.
4. Quartz agglomerate apron fronts.
5. Quartz agglomerate vanities.
6. Quartz agglomerate window sills.
7. Adhesives and sealants.

B. Related Requirements:

1. Section 05.5000 "Metal Fabrications".
2. Section 06.1000 "Rough Carpentry".
3. Section 07.9200 "Joint Sealants".
4. Section 12.3200 "Manufactured Casework".
5. Section 22.4100 "Residential Plumbing Fixtures" for sinks and plumbing fittings.

1.3 REFERENCES

A. ASTM C 97: Standard Test Methods for Absorption ad Bulk Specific Gravity of Dimension Stone.

B. ASTM C 170: Standard Test Method for Compressive Strength of Dimension Stone.

C. ASTM C 501: Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by Taber Abraser.

D. ASTM C 834: Standard Specification for Latex Sealants.

E. ASTM C 920: Standard Specification for Elastomeric Joint Sealants.

F. ASTM D 790: Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

G. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.

H. ISO: International Organization of Standardization.

I. ISO 9001: Quality Management Systems.

J. NSF/ANSI Standard 51: Food Equipment Materials.

K. SCAQMD Rule 1168: Adhesive and Sealant Applications.

L. UL 2818: GREENGUARD Certification Program for Chemical Emissions for Building Materials, Finishes, and Furnishings.

1.4 ACTION SUBMITTALS

A. Product Data: For countertop materials.

1. Submit data for each specified product. Include manufacturer's technical data sheets and published installation instructions.
2. Submit Safety Data Sheets (SDS) for adhesives and sealants.

B. Sustainable Design Submittals:
1. Product Data: For adhesives, indicating VOC content.

C. Shop Drawings: For countertops. Submit dimensioned shop drawings showing countertop layouts, backsplashes, vanities, window sills, joinery, edge conditions, terminations, substrate construction, cutouts, and holes.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.
3. Show plumbing installation provisions.

D. Samples for Initial Selection: For each type of material exposed to view.

E. Samples for Verification: For the following products:

1. Countertop material, 6 inches (150 mm) square.
2. One full-size quartz agglomerate countertop, with front edge and backsplash, 8 by 10 inches (200 by 250 mm), of construction and in configuration specified.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties.

C. Warranty: Submit specimen copy of specified warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For quartz agglomerate countertops to include in maintenance manuals. Submit manufacturer's published maintenance and care manual. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.7 QUALITY ASSURANCE

A. Regulatory Requirements

1. Accessibility Requirements: Comply with the U.S. Architectural & Transportation Barriers Compliance Board ADA-ABA Accessibility Guidelines for Buildings and Facilities.
2. Adhesives, Sealants, and Sealant Primers.

    a. SCAQMD (South Coast Air Quality Management District) Rule 1168.

B. Manufacturing Facility Qualifications: Quartz surfacing materials produced in an ISO 9001 certified facility.

C. Fabricator Qualifications: Minimum of five years documented experience in fabricating quartz surfacing countertops similar in scope and complexity to this Project, using water-cooled cutting tools. Currently certified by the manufacturer as an acceptable fabricator.

D. Installer Qualifications: Minimum of five years documented installation experience for projects similar in scope and complexity to this Project, and currently certified by the manufacturer as an acceptable installer.

E. A mockup may be a reasonable precaution for projects that require many quartz agglomerate countertops, but it may be impractical for other applications.

F. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and execution.

1. Build mockup of typical countertop as shown on Drawings.

2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's recommendations for shipping and handling quartz surfacing materials to preclude breakage and damage. Brace quartz surfacing units as necessary during shipment, transporting in near-vertical position with finished face towards finished face. Do not allow finished surfaces to rub during shipping and handling.

B. Store materials protected from exposure to harmful weather conditions, at temperature and humidity conditions recommended by the manufacturer. Store quartz surfacing sheet materials on racks in near-vertical position to preclude damage. Store with finished face turned towards finished face. Prevent warpage and breakage.

1.9 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops and openings by field measurements after base cabinets are installed but before countertop fabrication is complete. Show recorded measurements on shop drawings.

B. Adhesives: Acclimate adhesives to occupancy room temperatures with maximum temperature not to exceed 75 deg F (24 deg C).

1.10 COORDINATION

A. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

B. Coordinate locations of utilities that will penetrate countertops or backsplashes.

1.11 WARRANTY

A. Manufacturer's Limited Warranty: Standard 10 Year Commercial and Residential Limited Warranty against defects in quartz surfacing sheet materials.

PART 2 - PRODUCTS

2.1 QUARTZ AGGLOMERATE COUNTERTOP MATERIALS

A. Quartz Agglomerate: Solid sheets consisting of up to 93 percent quartz aggregate combined with polyester resin binders and proprietary pigments that are fabricated using vacuum vibrocompaction technology.

1. Basis-of-Design Product: (**QZ-01**) Subject to compliance with requirements, provide LX HAUSYS VIATERA or a comparable product by one of the following:

    a. Cambria
    b. Silestone

2. Composition: Up to 93 percent quartz aggregate combined with polyester resin binders and proprietary pigments that are fabricated into slab.
3. Material Thickness: 1.18 inch (3 cm)], nominal.
4. Material Weight: 620 LBS. for 63” X 130” slab (2 cm) thick surfacing.
5. Countertop Dimensions: As indicated on Drawings.
6. Vanity Dimensions: As indicated on Drawings
7. Window Sill Dimensions: As indicated on Drawings
8. Conformance Standards:

    a. NSF/ANSI Standard 51.
    b. UL 2818:

        1) GREENGUARD, emission levels in UL 2818, Section 7.1 are applicable for furniture products.
        2) GREENGUARD Gold, emission levels in UL 2818, Section 7.2 are applicable for building materials, finishes, and furnishings.

9. Physical Characteristics:

    a. Flexural Strength: Greater than 7,500; ASTM D 790.
    b. Stain resistance (24 Hour): No effect to moderate effect; NEMA LD-3.
    c. Abrasion Resistance: Greater than 100 in. lbs.; ASTM C 501.
    d. Density: Greater than 2.3 g/.cu. m per ASTM C 97.
    e. Compressive Strength (One Axis - Div.): Greater than 24,000 psi (138 MPa) per ASTM C 170.
    f. Moisture Absorption: Less than 0.07 percent per ASTM C 97.
    g. Surface Burning Characteristics: Class I and Class A per ASTM E 84.

10. Quartz Finish: Polished finish
11. Colors and Patterns:

a. **QZ-1** Suprema Nero

12. Edge Detail: Straight with Eased Edge

2.2 COUNTERTOP FABRICATION

A. General: Fabricate components in shop, to greatest extent practicable, in sizes and shapes indicated according to approved shop drawings and MSI Fabrication manual.

B. Joint Seams: Form joint seams between quartz surfacing components with specified seam adhesive. Completed joints inconspicuous in appearance and without voids. Provide joint reinforced if required by manufacturer for particular installation conditions.

C. Cutouts and Holes: Provide holes and cutouts for service fixtures and similar countertop-mounted items as indicated. Form cutouts to required template or pattern, with smooth, even curves and eased edges.

D. Countertops: 0.78-inch - (2-cm-) quartz agglomerate with integral edge.

E. Backsplashes: 0.78-inch - (2-cm-) thick, quartz agglomerate.

F. End Splash: Matching backsplash

G. Fabricate tops with shop-applied edges and backsplashes unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.

H. Joints: Fabricate countertops without joints.

I. Joints: Fabricate countertops in sections for joining in field

1. Joint Locations: Not within 18 inches (450 mm) of a sink or cooktop and not where a countertop section less than 36 inches (900 mm) long would result, unless unavoidable.

2.3 INSTALLATION MATERIALS

A. Joint Adhesive: Methacrylate-based adhesive for chemically bonding quartz surfacing seams. Color complementary to quartz surfacing sheet material. UL 2818 GREENGUARD Gold certified and complying with SCAQMD Rule 1168.

1. Basis-of-Design Product: Integra Surface Adhesive.

2. Adhesives shall have a VOC content of 70 > g/L or less.

B. Elastomeric Sealant: Mildew-resistant silicone sealant for filling gaps between countertops and terminating substrates in wet environment applications. Complies with ASTM C920, Type S (single component), Grade NS (nonsag).

1. Basis-of-Design Product: Color Matched Caulk.
2. Color: Complementary to quartz surfacing color

C. Siliconized Acrylic Sealant: Siliconized acrylic latex sealant. For general applications to fill gaps between countertops and at terminating substrates. Complies with ASTM C 384, Type OP, Grade NF, and SCAQMD Rule 1168.

1. Basis-of-Design Product: Color Matched Caulk.
2. Color: Complementary to quartz surfacing color

D. Construction Adhesive: Countertop manufacturer's recommended silicone-based construction adhesive for backsplashes, endsplashes, and other applications according to manufacturer's published fabrication instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive quartz agglomerate countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops. Substrates must be sound, flat, smooth, and free from dust or other surface contaminants.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 COUNTERTOP AND VANITY INSTALLATION

A. Install quartz surfacing components plumb, level, and true according to approved shop drawings and manufacturer's published installation instructions. Use woodworking and specialized fabrication tools acceptable to the manufacturer.

1. Fasten quartz surfacing components to base cabinets or other supporting substrates with suitable adhesives acceptable to manufacturer.

B. Form joint seams with specified seam adhesive. Seams to be inconspicuous in completed work. Seams in locations shown on approved shop drawings and acceptable to manufacturer. Promptly remove excess adhesive.

1. Clamp or brace quartz surfaces in position until adhesive sets.

C. Fill gaps between countertop and terminating substrates with specified silicone sealant.

D. Install backsplashes and endsplashes where indicated on Drawings. Adhere to countertops with specified construction adhesive.

E. Vanities: Secure front panels to solid substrate with specified construction adhesive.

1. ADA Vanities: Angled front to permit wheelchair access to comply with referenced accessibility standard.

3.3 WINDOW SILL INSTALLATION

A. Install window sills for full length of each window unit, securing to substrates with concealed fasteners and specified adhesives.

B. Provide minimum 1/8 inch (3.2 mm) expansion gap on both sides of window sills. Fill gap with specified joint sealant.

C. Completed work to be plumb, level, and true, with edges eased and smooth.

3.4 REPAIRS

A. If permissible to Architect, minor surface marring for quartz surfacing components may be repaired according to manufacturer's published installation instructions.

B. Remove and replace quartz surfacing components that are damaged and cannot be satisfactorily repaired.

3.5 CLEANING AND PROTECTION

A. Clean quartz surfacing components according to manufacturer's published maintenance instructions.

B. Completely remove excess adhesives and sealants from finished surfaces.

C. Protect completed work from damage during remainder of construction period.

END OF SECTION 12.3661.19

SECTION 12.9300 - STREETSCAPE ITEMS

PART 1 - GENERAL

1.01 SECTION DESCRIPTION

A. The Work of This Section Includes:

1. This section is a materials specification covering streetscape items.

1.02 CERTIFICATION

A. Contractor shall provide to Engineer a certificate stating the name, product name, style number, and other pertinent information to fully describe the product.

1.03 SHIPMENT AND STORAGE

A. Product labels shall clearly show the manufacturer or supplier name and style number.

B. During storage, products shall be elevated off the ground, out of direct sunlight, away from sources of dust and dirt.

PART 2 - PRODUCTS

A. Materials shall be provided as indicated on the Drawings.

PART 3 - EXECUTION

A. Products shall be installed as per the manufacturer’s product specific installation instructions.

END OF SECTION

SECTION 14.2100 – ELECTRIC TRACTION ELEVATOR #1

PART 1 - GENERAL

1.01 SUMMARY

A. This section specifies electric traction elevators.

B. Work Required:

1. The work required under this section consists of all labor, materials and services required for the complete installation (including operational verification) of all the equipment required for the elevator(s) as herein specified.
2. All work shall be performed in a first class, safe and workmanlike manner.
3. In all cases where a device or part of the equipment is herein referred to in the singular, it is intended that such reference shall apply to as many of such devices or parts as are required to make complete installation.

1.02 RELATED SECTIONS

A. The following sections contain requirements that relate to this section and are performed by trades other than the elevator manufacturer/installer.

1. Section 01.5000 – Temporary Facilities and Controls: protection of floor openings and personnel barriers; temporary power and lighting.
2. Section 03.3000 – Cast-In-Place Concrete: elevator pit and elevator machine foundation.
3. Section 04.2000 – Unit Masonry: masonry hoistway enclosure, building-in and grouting hoistway doorframes, and grouting of sills.
4. Section 05.5000 – Metal Fabrications: pit ladder, divider beams, supports for entrances and rails, and hoisting beam at top of elevator hoistway.
5. Section 07.1600 – Cementitious Waterproofing: waterproofing of elevator pit.
6. Section 23.5000 – Heat Generation Equipment: ventilation and temperature control of elevator equipment areas.
7. Section 26.0500 – Common Work Results for Electrical:

a. Main disconnects for each elevator.
b. Electrical power for elevator installation and testing.
c. Disconnecting device to elevator equipment prior to activation of sprinkler system.
d. The installation of dedicated GFCI receptacles in the pit and overhead.
e. Lighting in controller area, machine area and pit.
f. Wiring for telephone service to controller.

8. Section 26.3000 – Emergency (Standby) Power Supply Systems: emergency generator for elevator operation.
9. Section 27.3000 – Voice Communications: ADAAG-required emergency communications equipment.
10. Section 28.3100 – Fire Alarm Systems: fire and smoke detectors at required locations and interconnecting devices; fire alarm signal lines to contacts in the machine area.
11. Section 31.1000 – Site Clearing: excavation for elevator pit.

1.03 REFERENCES

A. Comply with applicable building and elevator codes at the project site, including but not limited to the following:

1. ASME A17.1/CSA B44, Safety Code for Elevators and Escalators.
2. ASME A17.7/CSA B44, Performance-Based Safety Code for Elevators and Escalators.
3. ADAAG, American Disabilities Act Accessibility Guidelines.
4. ANSI A117.1, Building and Facilities, Providing Accessibility and Usability for Physically Handicapped People.
5. ANSI/NFPA 70, (NEC) National Electrical Code.
6. CAN/CSA C22.1, (CEC) Canadian Electrical Code.
7. ANSI/UL 10B, Standard for Fire Test of Door Assemblies.
8. CAN/ULC-S104-10, Standard Method for Fire Test of Door Assemblies.
9. ANSI/NFPA 80, Standard for Fire Doors and Other Opening Protectives.
10. Building Codes IBC or NBCC.
11. All Local Jurisdictional applicable codes.

1.04 SYSTEM DESCRIPTION

A. Equipment Description: Gen3 Core™ gearless machine-room less elevator where all components fit inside the hoistway.
B. Equipment Control: Otis GCS Controller.
C. IoT Connectivity: Elevator connected to Otis ONE™ IoT Platform
D. Drive: Regenerative
E. Quantity of Elevators: 1
F. Elevator Stop Designations: 1, 2
G. Stops: 2
H. Openings: Front Only
I. Travel: 14'-0" (4267 mm)
J. Pit Depth: 5'-0" (1524 mm)
K. Rated Capacity: 2100 lb (953 kg)
L. Rated Speed: 200 fpm (1.02 m/s)
M. Cab Height: 7'-9" (2362 mm).
N. Clear Cab Height: 7'-7 ¾" (2330 mm) with 1 ¼" (32 mm) Floor Recess.
O. Entrance Type and Width:
P. Entrance Height: 7'-0" (2134 mm)
Q. Main Power Supply: 480 volts ± 5% of normal, three-phase, with a separate equipment grounding conductor.
R. Car Lighting Power Supply: 120 volts, single-phase, 15 amps, 60 Hz.
S. Machine Location: Rail-mounted at the top of the hoistway.
T. Signal Fixtures: Manufacturer's standard with metal button targets (excluding CA).
U. Controller Location: Machine Roomless controller(s) must be jamb-mounted on the same side as the counterweight, located at the top landing.
V. Performance:
    1. Car Speed: ±3 % of contract speed under any loading condition or direction of travel.
    2. Car Capacity: Safely lower, stop and hold up to 120% of rated load (code required).
    3. Ride Quality:
        a. Vertical Vibration (maximum): 20 milli-g
        b. Horizontal Vibration (maximum): 12 milli-g
        c. Vertical Jerk (maximum): 4.59 ± 1.0 ft./ sec3 (1.4 ± 0.3 m/ sec3)

d. Acceleration/Deceleration (maximum): 2.62 ft./ sec2 (0.8 m/ sec2)

e. In Car Noise: 55 – 60 dB(A)

f. Stopping Accuracy: ± 0.375 in. (± 10 mm) max, ± 0.25 in. (± 6 mm) Typical

g. Re-leveling Distance: ± 0.5 in. (± 12 mm)

W. Operation: Simplex Collective Operation: Using a microprocessor-based controller, operation shall be automatic by means of the car and hall buttons. If all calls in the system have been answered, the car shall park at the last landing served.

X. Operation Features – Standard

1. Full Collective Operation
2. Anti-nuisance.
3. Fan and Light Protection.
4. Load Weighing Bypass.
5. Independent Service.
6. Firefighters' Service Phase I and Phase II (USA only); or Special Emergency Service Phase I and II – Emergency Recall and In-Car Emergency Operation (Canada only).
7. Top of Car Inspection.
8. Zoned Access at Bottom Landing.
9. Zoned Access at Top Landing.

Y. Operation Features – Optional

1. Express Priority Service with key-switch(es)
2. Emergency Hospital Service.
3. Automatic Rescue Operation
4. Automatic Standby Power Operation with Manual Override.

Z. Door Control Features:

1. Door control to open doors automatically when car arrives at a landing in response to a normal hall or car call.
2. Elevator doors shall be provided with a reopening device that will stop and reopen the car door(s) and hoistway door(s) automatically should the door(s) become obstructed by an object or person.
3. Door protection shall consist of a two-dimensional or a code required, three-dimensional, multi-beam array projecting across the car door opening.
4. Door nudging operation to occur if doors are prevented from closing for an

adjustable period of time.

AA. Provide equipment for seismic conditions: Yes.

1.05 SUBMITTALS

A. Product Data: Submit manufacturer's product data for each system proposed for use. Include the following:
   1. Signal and operating fixtures, operating panels and indicators.
   2. Cab design, dimensions and layout.
   3. Hoistway-door and frame details.
   4. Electrical characteristics and connection requirements.
   5. Expected heat dissipation of elevator equipment in hoistway (BTU).
   6. Color selection chart for Cab and Entrances.

B. Shop Drawings: Submit approval layout drawings. Include the following:
   1. Car, guide rails, buffers, and other components in hoistway.
   2. Maximum rail bracket spacing.
   3. Maximum loads imposed on guide rails requiring load transfer to building structure.
   4. Clearances and travel of car.
   5. Clear inside hoistway and pit dimensions.
   6. Location and sizes of access doors, hoistway entrances and frames.

C. Operations and Maintenance Manuals: Provide manufacturer's standard operations and maintenance manual.

1.06 QUALITY ASSURANCE

A. Manufacturer: Elevator manufacturer shall be ISO 9001 certified.

B. Manufacturer shall have a minimum of fifteen years of experience in the fabrication, installation and service of elevators.

C. Installer: Elevators shall be installed by the manufacturer.

D. Permits, Inspections and Certificates: The Elevator Contractor shall obtain and pay for necessary Municipal or State Inspection and permit as required by the elevator inspection authority, and make such tests as are called for by the regulations of such authorities. These tests shall be made in the presence of such authorities or their authorized representatives.

1.07 DELIVERY, STORAGE AND HANDLING

A. Should the building or the site not be prepared to receive the elevator equipment at the

agreed upon date, the General Contractor will be responsible to provide a proper and suitable storage area on or off the premises.

B. Should the storage area be off-site, and the equipment not yet delivered, then the elevator contractor, upon notification from the General Contractor, will divert the elevator equipment to the storage area. If the equipment has already been delivered to the site, then the General Contractor shall transport the elevator equipment to the storage area. The cost of elevator equipment taken to storage by either party, storage, and redeliver to the job site shall not be at the expense of the elevator contractor.

1.08 WARRANTY

A. The elevator contractor's acceptance is conditional on the understanding that their warranty covers defective material and workmanship. The warranty period shall not extend longer than one (1) year from the date of Substantial Completion or acceptance thereof by beneficial use, whichever is earlier, of each elevator. The warranty excludes: ordinary wear and tear, improper use, vandalism, abuse, misuse, or neglect or any other causes beyond the control of the elevator contractor and this express warranty is in lieu of all other warranties, express or implied, including any warranty of merchantability or fitness for a particular purpose.

1.09 MAINTENANCE AND SERVICE

A. Maintenance service consisting of regular examinations and adjustments of the elevator equipment shall be provided by the elevator contractor for a period of 12 Months after the elevator has been turned over for the customer's use. This service shall not be subcontracted but shall be performed by the elevator contractor. All work shall be performed by competent employees during regular working hours of regular working days. This service shall not cover adjustments, repairs, or replacement of parts due to negligence, misuse, abuse or accidents caused by persons other than the elevator contractor. Only genuine parts and supplies as used in the manufacture and installation of the original equipment shall be provided.

B. The periodic lubrication of elevator components shall not be required, including Sheaves, Rails, Belts, Ropes, Car and Counterweight guides, etc.

C. The elevator control system must:

1. Provide in the controller the necessary devices to run the elevator on inspection operation.
2. Provide on top of the car the necessary devices to run the elevator in inspection operation.
3. Provide in the controller an emergency stop switch. This emergency stop switch when opened disconnects power from the brake and prevents the motor from running.

4. Provide in the event of a power outage, means from the controller to electrically lift and control the elevator brake to safely bring the elevator to the nearest available landing.
5. Provide the means from the controller to reset the governor over speed switch and also trip the governor.
6. Provide the means from the controller to reset the emergency brake when set because of an unintended car movement or ascending car over speed.
7. Provide the means from the controller to reset elevator earthquake operation.

D. Provide system capabilities to enable a remote expert to create a live, interactive connection with the elevator system to enable the following functions:
   1. Remotely diagnose elevator issues with a remote team of experts
   2. Remotely return an elevator to service
   3. Provide real-time status updates via email
   4. Remotely make changes to selected elevator functions including:
      a. Control building traffic: Restrict floor access, remove car from group operation, shut down elevator, select up peak/down peak mode and activate independent service.
      b. Conserve energy: Activate cab light energy save mode, activate fan energy save mode, shut down car(s).
      c. Improve passenger experience: Extend door open times, change parking floor, activate auto car full, activate anti-nuisance, advance door opening, door nudging, extend specific floor extended opening time, release trapped passengers.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Manufacturer: Design based upon Otis Elevator's Gen3 Core™ machine room-less elevator system.

2.02 DESIGN AND SPECIFICATIONS

A. Provide Gen3™ Core traction passenger elevators from Otis Elevator Company. The control system and car design based on materials and systems manufactured by Otis Elevator Company. Specifically, the system shall consist of the following components:
   1. Controller located entirely inside the hoistway.
   2. An AC gearless machine using embedded permanent magnets mounted at the top of the hoistway.

3. Polyurethane Coated-Steel Belts for elevator hoisting purposes.
4. Regenerative drive that captures normally wasted energy and feeds clean power back into the building's power grid.
5. LED lighting standard in ceiling lights and elevator fixtures.
6. Sleep mode operation for LED ceiling lights and car fan.

B. Approved Installer: Otis Elevator Company

C. Alternate Manufacturers: Subject to compliance with requirements:
1. Schindler Elevator Corporation
2. TKE

2.03 EQUIPMENT: CONTROLLER COMPONENTS

A. Controller: A microcomputer-based control system shall be provided to perform all of the functions of safe elevator operation. The system shall also perform car and group operational control.
1. All high voltage (110V or above) contact points inside the controller shall be protected from accidental contact when the controller doors are open.
2. Controller shall be separated into two distinct halves: Motor Drive side and Control side. High voltage motor power conductors shall be routed so as to be physically segregated from the rest of the controller.
3. Field conductor terminations points shall be segregated; high voltage (>30 volts DC and 110 VAC,) and low voltage (< 30 volts DC)
4. Controllers shall be designed and tested for Electromagnetic Interference (EMI) immunity according to the EN 12016 (May 1998): "EMC Product Family Standards for lifts, escalators, and passenger conveyors Part 2 – immunity"
5. Controller shall be located inside the wall next to the top landing entrance frame. Emergency access shall be provided through an access panel in the entrance frame secured by a key lock.

B. Drive: A Variable Voltage Variable Frequency AC drive system shall be provided. The drive shall be set up for regeneration of AC power back to the building grid.

2.04 EQUIPMENT: HOISTWAY COMPONENTS

A. Machine: AC gearless machine, with a synchronous permanent-magnet motor, dual solenoid service and emergency disc brakes, mounted at the top of the hoistway.

B. Governor: The governor shall be a tension type car-mounted governor.

C. Buffers, Car, and Counterweight: Polyurethane type buffers shall be used for speeds of 150 and 200 feet per minute.

D. Hoistway Operating Devices:

1. Emergency stop switch in the pit.
2. Terminal stopping switches.

E. Positioning System: Consists of an encoder, reader box, and door zone vanes.

F. Guide Rails and Attachments: Guide rails shall be Tee-section steel rails with brackets and fasteners. Side counterweight arrangements shall have a dual-purpose bracket that combines both counterweight guide rails, and one of the car guide rails to building fastening.

G. Coated-Steel Belts: Polyurethane coated belts with high-tensile-grade, zinc-plated steel cords and a flat profile on the running surface and the backside of the belt. The belts shall have an FT-1 rating as referenced by NFPA 13. All driving sheaves and deflector sheaves should have a crowned profile to ensure center tracking of the belts. A continuous 24/7 monitoring system using resistance-based technology has to be installed to continuously monitor the integrity of the coated steel belts and provide advanced notice of belt wear.

H. Governor Rope: Shall be steel and shall consist of at least eight strands wound about a sisal core center.

I. Fascia: Galvanized sheet steel shall be provided in accordance with code requirements.

J. Hoistway Entrances:

1. Frames: Entrance frames shall be of bolted construction for complete one-piece unit assembly. All frames shall be securely fastened to fixing angles mounted in the hoistway and shall be of UL fire rated steel. The entrance profile (jamb face) shall be a width of 2 7/8” (73 mm).
2. Sills shall be extruded aluminum.
3. Doors: Entrance doors shall be of metal construction with vertical channel reinforcements.
4. Fire Rating: Entrance and doors shall be UL fire rated for 1-½ hour.
5. Entrance Finish: Satin Stainless Steel.
6. Entrance Marking Plates: Entrance jambs shall be marked with 4” x 4” (102 mm x 102 mm) plates having raised floor markings with Braille located adjacent to the floor marking. Marking plates shall be provided on both sides of the entrance.
7. Sight Guards: Sight guards will be furnished with all doors painted to match with painted doors, painted black for stainless steel doors.

2.05 EQUIPMENT: CAR COMPONENTS

A. Car Frame and Safety: A car frame fabricated from formed or structural steel members shall be provided with adequate bracing to support the platform and car enclosures. The car safety shall be integral to the car frame and shall be Type "B", flexible guide clamp

type.

B. Cab: Steel Cab with vertical steel panels shall be brushed stainless steel.

C. Car Front Finish: Satin Stainless Steel

D. Car Door Finish: Satin Stainless Steel

E. Flush Ceiling with 4 LED Lights for passenger capacities and 8 LED lights for service capacities.

F. Ceiling Finish: Satin Stainless Steel

G. Emergency Car Lighting: An emergency power unit employing a 6-volt sealed rechargeable battery and totally static circuits shall be provided to illuminate the elevator car in the event of building power failure.

H. Fan: A one-speed 120 VAC fan will be mounted to the ceiling to facilitate in-car air circulation, meeting A17.1 code requirements. The fan shall be rubber mounted to prevent the transmission of structural vibration and will include a baffle to diffuse audible noise. A switch shall be provided in the car-operating panel to control the fan.

I. Handrails: Provided on the side and rear walls of the car enclosure. They shall be,1½" diameter (38.1 mm) Round Bar Handrails with a Brushed Steel Finish.

J. Threshold: Extruded Aluminum.

K. Emergency Exit Contact: An electrical contact shall be provided on the car-top exit.

L. Guides: The car shall have 3" diameter roller guides at top and bottom and the counterweight shall have slide type guides at the top and the bottom. Optional counterweight guides available.

M. Platform: The car platform shall be constructed of metal. Load weighing device shall be mounted on the belts at the top of the hoistway.

N. The LED ceiling lights, and the fan should automatically shut off when the system is not in use and be powered back up after a passenger calls the elevator and pushes a hall button.

O. Certificate frame: Provide a Certificate frame with a satin stainless steel finish.

P. Provide Otis cab UVC light purification device.

Q. Provide Otis cab air purifier.

R. Provide a complete set of Elevator Cab Pads.

2.06 EQUIPMENT: SIGNAL DEVICES AND FIXTURES

A. Car Operating Panel: A Standard Otis ONE™ Pro flat applied car operating panel shall be provided which contains all push buttons, key switches, and message indicators for elevator operation. The car operating panel shall have a brushed stainless steel finish and include a service cabinet.

1. The car operating panel shall contain a bank of round stainless steel, mechanical LED illuminated buttons. Flush mounted to the panel and marked to correspond to the landings served. All buttons to have raised numerals and Braille markings with Flush Mounted satin stainless steel buttons with white LED illuminating halos.
2. The car operating panel shall be equipped with the following features:
    a. Raised markings and Braille to the left-hand side of each push-button.
    b. Car Position Indicator at the top of and integral to the car operating panel.
    c. Door open and door close buttons.
    d. Inspection key-switch.
    e. Elevator Data Plate marked with elevator capacity and car number.
    f. Help Button: The help button shall initiate two-way communication between the car and a location inside the building, switching over to another location if the call is unanswered, where personnel are available who can take the appropriate action. Visual indicators are provided for call initiation and call acknowledgement.
    g. Display Screen: Include display screen located near the top of the COP. The display screen shall display the car position indicator, travel direction arrows, elevator status jewels, and provide emergency text communication.
    h. Camera: Include camera located above display screen for emergency video communication. This camera is for emergency communication only.
    i. Landing Passing Signal: A chime bell shall sound in the car to signal that the car is either stopping at or passing a floor served by the elevator.
    j. In car stop switch (toggle or key unless local code prohibits use)
    k. Firefighter's hat.
    l. Firefighter's Phase II Key-switch.
    m. Call Cancel Button.
    n. Firefighter's Phase II Emergency In-Car Operating Instructions: worded according to A17.1 2000, Article 2.27.7.2.
    o. Please Exit Symbol: provided with emergency hospital service, or express priority in the hall.

B. Car Position Indicator: A digital, LED car position indicator shall be integral to the car operating panel.

C. Hall Fixtures: Hall fixtures shall be provided with necessary push buttons and key switches for elevator operation. Hall fixtures shall include:
    1. Flush Mounted satin stainless steel buttons with white LED illuminating halos.

2. Car Lantern and Chime: A directional lantern visible from the corridor shall be provided in the car entrance. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel, and a chime will sound.

D. Access key-switch at top floor in entrance jamb.

E. Access key-switch at lowest floor in entrance jamb.

F. Card Reader Provision.

G. Emergency Hospital Service.

PART 3 - EXECUTION

3.01 PREPARATION

A. Take field dimensions and examine conditions of substrates, supports, and other conditions under which this work is to be performed. Do not proceed with work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Installation of all elevator components except as specifically provided for elsewhere by others.

3.03 DEMONSTRATION

A. The elevator contractor shall make a final check of each elevator operation with the Owner or Owner's representative present prior to turning each elevator over for use. The elevator contractor shall determine that the control systems and operating devices are functioning properly.

END OF SECTION 14.2100

SECTION 14.2200 – ELECTRIC TRACTION ELEVATOR #2

PART 1 - GENERAL

1.01 SUMMARY

A. This section specifies electric traction elevators.

B. Work Required:

1. The work required under this section consists of all labor, materials and services required for the complete installation (including operational verification) of all the equipment required for the elevator(s) as herein specified.
2. All work shall be performed in a first class, safe and workmanlike manner.
3. In all cases where a device or part of the equipment is herein referred to in the singular, it is intended that such reference shall apply to as many of such devices or parts as are required to make complete installation.

1.02 RELATED SECTIONS

A. The following sections contain requirements that relate to this section and are performed by trades other than the elevator manufacturer/installer.

1. Section 01.5000 – Temporary Facilities and Controls: protection of floor openings and personnel barriers; temporary power and lighting.
2. Section 03.3000 – Cast-In-Place Concrete: elevator pit and elevator machine foundation.
3. Section 04.2000 – Unit Masonry: masonry hoistway enclosure, building-in and grouting hoistway doorframes, and grouting of sills.
4. Section 05.5000 – Metal Fabrications: pit ladder, divider beams, supports for entrances and rails, and hoisting beam at top of elevator hoistway.
5. Section 07.1600 – Cementitious Waterproofing: waterproofing of elevator pit.
6. Section 23.5000 – Heat Generation Equipment: ventilation and temperature control of elevator equipment areas.
7. Section 26.0500 – Common Work Results for Electrical:

a. Main disconnects for each elevator.
b. Electrical power for elevator installation and testing.
c. Disconnecting device to elevator equipment prior to activation of sprinkler system.
d. The installation of dedicated GFCI receptacles in the pit and overhead.
e. Lighting in controller area, machine area and pit.
f. Wiring for telephone service to controller.

8. Section 26.3000 – Emergency (Standby) Power Supply Systems: emergency generator for elevator operation.
9. Section 27.3000 – Voice Communications: ADAAG-required emergency communications equipment.
10. Section 28.3100 – Fire Alarm Systems: fire and smoke detectors at required locations and interconnecting devices; fire alarm signal lines to contacts in the machine area.
11. Section 31.1000 – Site Clearing: excavation for elevator pit.

1.03 REFERENCES

A. Comply with applicable building and elevator codes at the project site, including but not limited to the following:

1. ASME A17.1/CSA B44, Safety Code for Elevators and Escalators.
2. ASME A17.7/CSA B44, Performance-Based Safety Code for Elevators and Escalators.
3. ADAAG, American Disabilities Act Accessibility Guidelines.
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1.04 SYSTEM DESCRIPTION

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B. Equipment Control: Otis GCS Controller.

C. IoT Connectivity: Elevator connected to Otis ONE™ IoT Platform

D. Drive: Regenerative

E. Quantity of Elevators: 1

F. Elevator Stop Designations: 1, 2

G. Stops: 2

H. Openings: Front and Rear

I. Travel: 14'-0" (4267 mm)

J. Pit Depth: 5'-0" (1524 mm)

K. Rated Capacity: 3500 lb (1589 kg)

L. Rated Speed: 200 fpm (1.02 m/s)

M. Cab Height: 7'-9" (2362 mm).

N. Clear Cab Height: 7'-7 ¾" (2330 mm) with 1 ¼" (32 mm) Floor Recess.

O. Entrance Type and Width:

P. Entrance Height: 7'-0" (2134 mm)

Q. Main Power Supply: 480 volts ± 5% of normal, three-phase, with a separate equipment grounding conductor.

R. Car Lighting Power Supply: 120 volts, single-phase, 15 amps, 60 Hz.

S. Machine Location: Rail-mounted at the top of the hoistway.

T. Signal Fixtures: Manufacturer's standard with metal button targets (excluding CA).

U. Controller Location: Machine Roomless controller(s) must be jamb-mounted on the same side as the counterweight, located at the top landing.

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3. Ride Quality:
   a. Vertical Vibration (maximum): 20 milli-g
   b. Horizontal Vibration (maximum): 12 milli-g
   c. Vertical Jerk (maximum): 4.59 ± 1.0 ft./ sec^3 (1.4 ± 0.3 m/ sec^3)

d. Acceleration/Deceleration (maximum): 2.62 ft./ sec^2 (0.8 m/ sec^2)

e. In Car Noise: 55 – 60 dB(A)

f. Stopping Accuracy: ± 0.375 in. (± 10 mm) max, ± 0.25 in. (± 6 mm) Typical

g. Re-leveling Distance: ± 0.5 in. (± 12 mm)

W. Operation: Simplex Collective Operation: Using a microprocessor-based controller, operation shall be automatic by means of the car and hall buttons. If all calls in the system have been answered, the car shall park at the last landing served.

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1. Full Collective Operation
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adjustable period of time.

AA. Provide equipment for seismic conditions: Yes.

1.05 SUBMITTALS

A. Product Data: Submit manufacturer's product data for each system proposed for use. Include the following:
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A. Maintenance service consisting of regular examinations and adjustments of the elevator equipment shall be provided by the elevator contractor for a period of 12 Months after the elevator has been turned over for the customer's use. This service shall not be subcontracted but shall be performed by the elevator contractor. All work shall be performed by competent employees during regular working hours of regular working days. This service shall not cover adjustments, repairs, or replacement of parts due to negligence, misuse, abuse or accidents caused by persons other than the elevator contractor. Only genuine parts and supplies as used in the manufacture and installation of the original equipment shall be provided.

B. The periodic lubrication of elevator components shall not be required, including Sheaves, Rails, Belts, Ropes, Car and Counterweight guides, etc.

C. The elevator control system must:

1. Provide in the controller the necessary devices to run the elevator on inspection operation.
2. Provide on top of the car the necessary devices to run the elevator in inspection operation.
3. Provide in the controller an emergency stop switch. This emergency stop switch when opened disconnects power from the brake and prevents the motor from running.

4. Provide in the event of a power outage, means from the controller to electrically lift and control the elevator brake to safely bring the elevator to the nearest available landing.
5. Provide the means from the controller to reset the governor over speed switch and also trip the governor.
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7. Provide the means from the controller to reset elevator earthquake operation.

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   2. Remotely return an elevator to service
   3. Provide real-time status updates via email
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      a. Control building traffic: Restrict floor access, remove car from group operation, shut down elevator, select up peak/down peak mode and activate independent service.
      b. Conserve energy: Activate cab light energy save mode, activate fan energy save mode, shut down car(s).
      c. Improve passenger experience: Extend door open times, change parking floor, activate auto car full, activate anti-nuisance, advance door opening, door nudging, extend specific floor extended opening time, release trapped passengers.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Manufacturer: Design based upon Otis Elevator's Gen3 Core™ machine room-less elevator system.

2.02 DESIGN AND SPECIFICATIONS

A. Provide Gen3™ Core traction passenger elevators from Otis Elevator Company. The control system and car design based on materials and systems manufactured by Otis Elevator Company. Specifically, the system shall consist of the following components:
   1. Controller located entirely inside the hoistway.
   2. An AC gearless machine using embedded permanent magnets mounted at the top of the hoistway.

3. Polyurethane Coated-Steel Belts for elevator hoisting purposes.
4. Regenerative drive that captures normally wasted energy and feeds clean power back into the building's power grid.
5. LED lighting standard in ceiling lights and elevator fixtures.
6. Sleep mode operation for LED ceiling lights and car fan.

B. Approved Installer: Otis Elevator Company

C. Alternate Manufacturers: Subject to compliance with requirements:
1. Schindler Elevator Corporation
2. TKE

2.03 EQUIPMENT: CONTROLLER COMPONENTS

A. Controller: A microcomputer-based control system shall be provided to perform all of the functions of safe elevator operation. The system shall also perform car and group operational control.
1. All high voltage (110V or above) contact points inside the controller shall be protected from accidental contact when the controller doors are open.
2. Controller shall be separated into two distinct halves: Motor Drive side and Control side. High voltage motor power conductors shall be routed so as to be physically segregated from the rest of the controller.
3. Field conductor terminations points shall be segregated; high voltage (>30 volts DC and 110 VAC,) and low voltage (< 30 volts DC)
4. Controllers shall be designed and tested for Electromagnetic Interference (EMI) immunity according to the EN 12016 (May 1998): "EMC Product Family Standards for lifts, escalators, and passenger conveyors Part 2 – immunity"
5. Controller shall be located inside the wall next to the top landing entrance frame. Emergency access shall be provided through an access panel in the entrance frame secured by a key lock.

B. Drive: A Variable Voltage Variable Frequency AC drive system shall be provided. The drive shall be set up for regeneration of AC power back to the building grid.

2.04 EQUIPMENT: HOISTWAY COMPONENTS

A. Machine: AC gearless machine, with a synchronous permanent-magnet motor, dual solenoid service and emergency disc brakes, mounted at the top of the hoistway.

B. Governor: The governor shall be a tension type car-mounted governor.

C. Buffers, Car, and Counterweight: Polyurethane type buffers shall be used for speeds of 150 and 200 feet per minute.

D. Hoistway Operating Devices:

1. Emergency stop switch in the pit.
2. Terminal stopping switches.

E. Positioning System: Consists of an encoder, reader box, and door zone vanes.

F. Guide Rails and Attachments: Guide rails shall be Tee-section steel rails with brackets and fasteners. Side counterweight arrangements shall have a dual-purpose bracket that combines both counterweight guide rails, and one of the car guide rails to building fastening.

G. Coated-Steel Belts: Polyurethane coated belts with high-tensile-grade, zinc-plated steel cords and a flat profile on the running surface and the backside of the belt. The belts shall have an FT-1 rating as referenced by NFPA 13. All driving sheaves and deflector sheaves should have a crowned profile to ensure center tracking of the belts. A continuous 24/7 monitoring system using resistance-based technology has to be installed to continuously monitor the integrity of the coated steel belts and provide advanced notice of belt wear.

H. Governor Rope: Shall be steel and shall consist of at least eight strands wound about a sisal core center.

I. Fascia: Galvanized sheet steel shall be provided in accordance with code requirements.

J. Hoistway Entrances:

1. Frames: Entrance frames shall be of bolted construction for complete one-piece unit assembly. All frames shall be securely fastened to fixing angles mounted in the hoistway and shall be of UL fire rated steel. The entrance profile (jamb face) shall be a width of 2 7/8" (73 mm).
2. Sills shall be extruded aluminum.
3. Doors: Entrance doors shall be of metal construction with vertical channel reinforcements.
4. Fire Rating: Entrance and doors shall be UL fire rated for 1-½ hour.
5. Entrance Finish: Satin Stainless Steel.
6. Entrance Marking Plates: Entrance jambs shall be marked with 4" x 4" (102 mm x 102 mm) plates having raised floor markings with Braille located adjacent to the floor marking. Marking plates shall be provided on both sides of the entrance.
7. Sight Guards: Sight guards will be furnished with all doors painted to match with painted doors, painted black for stainless steel doors.

2.05 EQUIPMENT: CAR COMPONENTS

A. Car Frame and Safety: A car frame fabricated from formed or structural steel members shall be provided with adequate bracing to support the platform and car enclosures. The car safety shall be integral to the car frame and shall be Type "B", flexible guide clamp

type.

B. Cab: Steel Cab with vertical steel panels shall be brushed stainless steel.

C. Car Front Finish: Satin Stainless Steel

D. Car Door Finish: Satin Stainless Steel

E. Flush Ceiling with 4 LED Lights for passenger capacities and 8 LED lights for service capacities.

F. Ceiling Finish: Satin Stainless Steel

G. Emergency Car Lighting: An emergency power unit employing a 6-volt sealed rechargeable battery and totally static circuits shall be provided to illuminate the elevator car in the event of building power failure.

H. Fan: A one-speed 120 VAC fan will be mounted to the ceiling to facilitate in-car air circulation, meeting A17.1 code requirements. The fan shall be rubber mounted to prevent the transmission of structural vibration and will include a baffle to diffuse audible noise. A switch shall be provided in the car-operating panel to control the fan.

I. Handrails: Provided on the side and rear walls of the car enclosure. They shall be,1½" diameter (38.1 mm) Round Bar Handrails with a Brushed Steel Finish.

J. Threshold: Extruded Aluminum.

K. Emergency Exit Contact: An electrical contact shall be provided on the car-top exit.

L. Guides: The car shall have 3" diameter roller guides at top and bottom and the counterweight shall have slide type guides at the top and the bottom. Optional counterweight guides available.

M. Platform: The car platform shall be constructed of metal. Load weighing device shall be mounted on the belts at the top of the hoistway.

N. The LED ceiling lights, and the fan should automatically shut off when the system is not in use and be powered back up after a passenger calls the elevator and pushes a hall button.

O. Certificate frame: Provide a Certificate frame with a satin stainless steel finish.

P. Provide Otis cab UVC light purification device.

Q. Provide Otis cab air purifier.

R. Provide a complete set of Elevator Cab Pads.

2.06 EQUIPMENT: SIGNAL DEVICES AND FIXTURES

A. Car Operating Panel: A Standard Otis ONE™ Pro flat applied car operating panel shall be provided which contains all push buttons, key switches, and message indicators for elevator operation. The car operating panel shall have a brushed stainless steel finish and include a service cabinet.

1. The car operating panel shall contain a bank of round stainless steel, mechanical LED illuminated buttons. Flush mounted to the panel and marked to correspond to the landings served. All buttons to have raised numerals and Braille markings with Flush Mounted satin stainless steel buttons with white LED illuminating halos.
2. The car operating panel shall be equipped with the following features:
    a. Raised markings and Braille to the left-hand side of each push-button.
    b. Car Position Indicator at the top of and integral to the car operating panel.
    c. Door open and door close buttons.
    d. Inspection key-switch.
    e. Elevator Data Plate marked with elevator capacity and car number.
    f. Help Button: The help button shall initiate two-way communication between the car and a location inside the building, switching over to another location if the call is unanswered, where personnel are available who can take the appropriate action. Visual indicators are provided for call initiation and call acknowledgement.
    g. Display Screen: Include display screen located near the top of the COP. The display screen shall display the car position indicator, travel direction arrows, elevator status jewels, and provide emergency text communication.
    h. Camera: Include camera located above display screen for emergency video communication. This camera is for emergency communication only.
    i. Landing Passing Signal: A chime bell shall sound in the car to signal that the car is either stopping at or passing a floor served by the elevator.
    j. In car stop switch (toggle or key unless local code prohibits use)
    k. Firefighter's hat.
    l. Firefighter's Phase II Key-switch.
    m. Call Cancel Button.
    n. Firefighter's Phase II Emergency In-Car Operating Instructions: worded according to A17.1 2000, Article 2.27.7.2.
    o. Please Exit Symbol: provided with emergency hospital service, or express priority in the hall.

B. Car Position Indicator: A digital, LED car position indicator shall be integral to the car operating panel.

C. Hall Fixtures: Hall fixtures shall be provided with necessary push buttons and key switches for elevator operation. Hall fixtures shall include:
    1. Flush Mounted satin stainless steel buttons with white LED illuminating halos.

2. Car Lantern and Chime: A directional lantern visible from the corridor shall be provided in the car entrance. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel, and a chime will sound.

D. Access key-switch at top floor in entrance jamb.

E. Access key-switch at lowest floor in entrance jamb.

F. Card Reader Provision.

G. Emergency Hospital Service.

PART 3 - EXECUTION

3.01 PREPARATION

A. Take field dimensions and examine conditions of substrates, supports, and other conditions under which this work is to be performed. Do not proceed with work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Installation of all elevator components except as specifically provided for elsewhere by others.

3.03 DEMONSTRATION

A. The elevator contractor shall make a final check of each elevator operation with the Owner or Owner's representative present prior to turning each elevator over for use. The elevator contractor shall determine that the control systems and operating devices are functioning properly.

END OF SECTION 14.2200

SECTION 21.0100 - GENERAL PROVISIONS

PART 1 - GENERAL

1.1 FIRE UNDERWRITER SEAL:

A. Where applicable, all material shall bear the National Board of Fire Underwriters' Seal of Approval. Certificates to this effect to be furnished to Architect upon request.

1.2 DEFINITION OF WORK RESPONSIBILITY:

A. Unless noted otherwise by the multiple contract summary, all work shall be performed as noted below.

B. All electrical control components including starters required for operation of Fire Protection equipment whether integral or remote shall be furnished and installed under this Contract. Control wiring, conduits and accessories for control devices shall be furnished and installed by the Contractor who provides the equipment. See Div. 26 specifications for starters, combination starters, and switches.

C. Power wiring from panelboards or similar source through all equipment disconnects to motors or heating equipment shall be furnished and installed by the Electrical Contractor.

D. Equipment disconnect switches, unless otherwise specified or supplied by the equipment supplier as an integral part of the equipment shall be furnished and installed by the Electrical Contractor.

E. All electrical equipment, components, and wiring furnished and installed under this portion of the specifications shall conform to all requirements of the applicable portions of the electrical specifications.

F. All base flashing, where required, shall be by the General Contractor, with necessary counter-flashing by this contractor.

G. All structural work needed for support of Fire Protection equipment or components shall be provided by this contractor unless shown on structural plans.

1.3 RULES AND REGULATIONS:

A. All work shall be performed in accordance with the rules and regulations of the ICC Codes, local plumbing code and ordinances, NFPA Code, and the public utilities having jurisdiction.

B. All work shall be performed in accordance with the rules and regulations of the Pennsylvania Department of Labor and Industry, Federal Department of Labor (Occupational Safety and Health Administration), the Department of Education, and all codes and agencies having jurisdiction.

C. All construction, design fabrication, tests, rating and installation shall comply with the rules and regulations of all local, state or national codes and agencies having jurisdiction over this project. Any costs involved in complying to these rules and regulations shall be included in original bid of this Contractor.

D. The Owner will obtain the building permit. Any other fees relative to the contractor’s work shall be paid by the contractor as part of his bid.

E. Contractor's must be licensed within the Municipality which the project is located. Copies of these licenses must be posted within the respective job trailers during construction.

1.4 ANCHOR BOLTS:

A. Contractor shall provide and set in place at the time the foundations, bases, or curbs are poured, all necessary anchor bolts as required for the various equipment specified herein, to be furnished under these Specifications. Anchor bolts must be of the hook type and of the proper sizes and length to suit the apparatus. The bolts shall be set in pipe sleeves of approximately twice the bolt diameter and as long as the imbedded length of the bolt.

B. When the equipment is set in its proper position, the bolt sleeves and the space between the rough foundations, bases or curbs of the equipment shall be completely filled with one inch of non-shrinking cement grout.

C. Contractor shall assume all responsibility for the location of all anchor bolts for the equipment furnished under these Specifications, and must have a supervisor present at the time the foundation, bases, or curbs are poured.

1.5 DRAWINGS:

A. The accompanying drawings are a part of these specifications and are intended to show approximate and relative locations of services and equipment. They shall not be scaled to determine exact positions, locations and clearances.

B. Due to the diagrammatic layout and small scale of the drawings, certain piping and duct rises, drops, offsets, valves, and related specialties are not shown. The Contractor shall provide all, piping, fittings, valves, and specialties required to insure a complete installation without additional cost to the Owner.

C. All drawings and specifications pertaining to general construction, plumbing, HVAC, electrical and other work shall be carefully examined. Where physical interferences with his work occur because of his failure to consult other trades, this Contractor shall rearrange his work at his own expense.

1.6 SUBMISSION OF SHOP DRAWINGS, EQUIPMENT AND MATERIALS

A. Refer to Division 1.

B. Contractors shall include with each submittal/shop drawing, a matrix outlining all items that do not match the specified unit. If an item is not listed on the matrix, the submitted unit will be assumed to meet all parts of the specification. Contractors will be responsible to ensure that the specifications are met in full. Items in matrix shall include scheduled performance data vs. submitted performance data, specified components vs. submitted unit components, specified construction weight, warranty, etc. vs. submitted construction, weight, warranty, etc.

1.7 VISIT TO THE SITE:

A. Prior to submission of his bid, the Contractor shall visit the site to acquaint himself with the existing conditions. Bids as submitted will be interpreted to include all costs and change made necessary by such conditions.

1.8 COORDINATION OF WORK:

A. Contractor shall coordinate his work with that of other trades. In case of interference or problems the Architect shall decide which work is to be relocated, regardless of which is installed first.

B. Contractor shall prepare coordination/arrangement CAD drawings for coordination with all other trades. The contractor shall furnish these coordination drawings to the contractor responsible for project BIM coordination.

C. This Contractor shall obtain approval of all arrangement drawings before continuing with installation of his work.

1.9 LOCATION OF EQUIPMENT:

A. All locations of fire protection equipment and associated pipe connections shall be verified by the Owner and Architect. The contractor shall verify locations sufficiently in advance of the installation to allow uninterrupted progress of the work of all trades.

1.10 MATERIALS AND EQUIPMENT:

A. All materials and equipment, unless otherwise specified, shall be new and of the best quality, and listed/approved for their specific application.

B. This Contractor shall provide, when required by the Architect, labeled samples of materials to be used on the project. Samples shall be submitted for approval by the Architect prior to their installation.

C. All materials and equipment installed by the Contractor shall be securely and rigidly supported from or attached to the building structure.

1.11 WORKMANSHIP:

A. All workmanship shall be done according to the best practices of the trade by qualified and competent tradesmen.

1.12 PROTECTION OF EQUIPMENT:

A. Contractor shall protect all furnished material and equipment from damage until final acceptance as installed. Contractor shall temporarily seal pipe openings during construction with temporary plugs and replace all damaged items with ones of exact sameness at his expense.

B. Contractor shall schedule material and systems for delivery in such a pattern that critical pieces of equipment may be stored within the building, protected from weather. Where materials are stored outside, they must be protected from the elements and damage.

C. Contractor shall be responsible for coordinating the procurement of specified materials and equipment being supplied by his sub-contractors and suppliers.

1.13 SCAFFOLDING AND HOISTING:

A. Contractor shall furnish and erect all scaffolding, hoists, shoring, platforms, railings, ladders, and other devices required by local, state, and federal laws to install his systems and equipment. Scaffolding and all other equipment shall be removed at completion of the work.

B. Contractor shall hoist or rig his own material and equipment into place, or arrange for the rigging of it by others at his expense.

1.14 FOREMAN:

A. Contractor must provide a competent foreman, subject to approval of the Owner. The foreman shall be deemed the agent of the Contractor and must be on duty at the building during all working hours.

B. Any instructions or notices given to the foreman shall have the same force as if given to the Contractor in person.

1.15 SLEEVES:

A. Contractor shall furnish and set all sleeves required for the installation of the work of this section and shall be responsible for their final and permanent locations.

B. Contractor shall fit pipes passing through masonry construction with sleeves. Each sleeve shall extend through its respective floor or wall and shall finish flush with each surface unless otherwise required. Unless otherwise specified or shown, sleeves shall be two pipe size larger than the overall outside diameter of the pipe when insulated. Sleeves in bearing and masonry walls shall be made of standard weight steel pipe. Sleeves through concrete floor slabs and other partitions shall be No. 2 U.S.S. gauge sheet metal or approved equal.

C. Where sleeves pass through foundation walls, the space between such sleeves and passing pipes shall be provided with preassembled "Link-Seals" as manufactured by Thunderline Corporation, 5495 Treadwell, Wayne, Michigan 48184.

D. All sleeves shall be properly installed and securely cemented in place. Where pipes pass through waterproofed floor or walls, design of sleeves shall be such that the waterproofing can be properly flashed around the sleeves, and of such height that the water will be restrained from entering sleeves and dripping to any finished areas below.

E. Where pipes pass through fire resisting portions of the structure, the annular space between the sleeve and the pipe shall be filled with an approved fire stopping material. Sleeve and sealant installation shall be UL Listed as an assembly for the required rating of the fire resistive structure. Refer to Div. 07 specifications for additional information.

1.16 CONCRETE AND MASONRY WORK:

A. Contractor shall furnish and install all concrete bases, reinforcing, etc. required to install the work of this Division, unless otherwise noted.

B. Prior to installing any forms, reinforcing or concrete, Contractor shall notify all other Contractors or subcontractors, in ample time for them to install any portion of their work which is to be concealed in the concrete. No such work shall be placed in a manner to interfere with the proper placing of the reinforcement unless so authorized by the Architect.

1.17 ESCUTCHEONS:

A. All exposed pipes, except as otherwise described, passing through walls, floors, ceilings, etc. in finished spaces, shall be provided with solid pattern heavy ceiling, floor or wall escutcheons with set screw. Escutcheons and plates shall be of steel or malleable iron with prime coat ready for painting. Escutcheons will not be provided where sleeves intentionally extend above finished floor.

B. All exposed piping passing through wall or floors shall be equipped with pressed brass, chromium plated, solid-type escutcheons.

1.18 ACCESS DOORS AND PANELS:

A. All ceiling and wall access panels not shown on the Architectural plans and required by work of this Division shall be furnished by this Contractor and set by the General Contractor. The location of these access panels must be approved by the Architect prior to their installation. The Contractor shall furnish

an access panel where valves, specialties, and other serviceable items are installed behind masonry, plaster, tile, or similar type non-removable surfaces.

B. Refer to Section 08 3113 - "Access Doors and Frames" for specific requirements.

1.19 CUTTING AND PATCHING:

A. Each Contractor shall give the General Contractor complete information as to size of openings to be provided by the General Contractor in new floors, and walls, etc., so that such openings may be provided as the project progresses.

B. If openings are omitted or are incorrect through failure of the Contractors to follow these instructions, the respective Contractors shall, at their own expense, engage the trade which originally installed the work, to cut and patch to the satisfaction of the Architect.

C. This Contractor shall be responsible for the cutting of existing floor slabs for the installation/demolition of any underground piping systems required by the work of this Division. The Contractor is responsible for proper bedding, backfill materials and compaction (as outlined in the specifications and on the drawings) to an elevation that is level with the bottom of the existing concrete floor slab. The Contractor is responsible for the patching of the floor slab, with proper materials which are equivalent to the adjacent finishes and materials. The new finished floor will be provided by the General Contractor.

D. Cutting and patching of exposed surfaces (other than the floor) of the building shall be the responsibility of each Contractor as required for installation of his work. All holes cut shall be in a manner approved by the Architect. Patching of existing construction and finishes are by the Contractor and must be equivalent to adjacent finishes and materials.

E. Cutting and patching of concealed surfaces (other than the floor) of the building shall be the responsibility of each Contractor as required for installation of his work. All holes cut shall be in a manner approved by the Architect. Patching of existing construction and finishes are by the Contractor and must be equivalent to adjacent finishes and materials.

F. Where it becomes necessary to cut out any portions of walls, floors, ceilings, roof or other portions of the building for the installation of work as may be required to perform and complete the work under this Contract, the Contractor shall do all necessary cutting and fitting, shall remove all excess material, and shall replace all work damaged so as to leave the entire premises in a finished condition.

G. No cutting shall be done which may in any way affect the building structurally or architecturally. Any damage incident to cutting or other causes in the performance of this Contract shall be made good by replacement or repairs. Cutting shall be done only with the prior approval of the Architect.

H. Contractor shall seal all piping penetrations through all walls and floors. Penetrations through fire rated walls or floors shall be sealed with an approved UL Listed fire stopping. Refer to Div. 07 for additional information

1.20 GUARANTEE:

A. Each Contractor shall unconditionally guarantee in writing all materials, equipment, and workmanship for a period as specified in Div. 01, from date of acceptance by Owner. The Contractor shall provide free service for all equipment provided under this Contract during this guarantee period.

B. The guarantee shall include restoration to its original condition of all adjacent work that must be disturbed in fulfilling this guarantee.

C. All such repairs and/or replacements shall be made without delay and at the convenience of the Owner.

1.21 CLEANING OF SYSTEMS:

A. The Contractors shall thoroughly clean all pipe systems to remove all grease, oil scale, core, sand and other foreign material after tests have been made and before the building is turned over to the Owner.

B. All strainers shall be opened and cleaned thoroughly.

C. Should the Contractor put any substance into any system to aid in the cleaning of it, all trace of such material shall be removed before the system is considered clean. All such substances, if used, shall be free from any acid that will set or injure valve seats in any way.

1.22 INSTRUCTION TO EMPLOYEES:

A. At the completion of the work, and before final acceptance of the building by the Owner, each Contractor, together with the representatives of the manufacturers of the equipment installed by the Contractor, shall instruct the designated employees of the Owner in the care, adjustment, maintenance and operation of equipment installed by the Contractor.

B. Contractor shall furnish three copies of factory maintenance schedules for each piece of equipment. Acceptance of materials and equipment is conditional upon receipts of maintenance manuals.

C. A representative of the manufacturer of each piece of equipment shall inspect the installation of furnished equipment, make final adjustments, and certify the equipment is properly installed and in satisfactory working condition.

1.23 SUBSTITUTIONS:

A. Refer to Division 01 for requirements in addition to the following:

1. Various items of equipment and materials that have been used as the basis for mechanical system design have been specified by a manufacturer's name and model number. Another manufacturer's product may be submitted for consideration as a substitute. The Architect shall be the sole judge as to the comparability of an item of equipment that is submitted for approval as a substitute for that which is specified. Each of the Contractor's substitute proposals shall include all labor and materials that will be required to install the equipment and make it operate satisfactorily in accordance with the original design concept. He shall include such things as changes in piping, valves, supports, fittings, ductwork, motors, controls, electrical wiring, and thermal insulation. It shall be the responsibility of the Contractor to make certain that substitute equipment, which has been accepted by the Architect will fit into the designated spaces. He shall make the necessary field measurements in order to determine that there is adequate space for the equipment, taking into consideration the clearances that are required for connections and servicing.
2. If any changes are required in the installation of mechanical or electrical services to any mechanical equipment accepted as substitutions to the basis of design, Contractor shall be responsible for any additional costs incurred to the Owner, Engineer, other contractors and costs incurred for changes to the coordination drawings

1.24 ALTERNATES:

A. Refer to Division 01 for requirements in addition to the following:

1. Various items of equipment and materials that have been used as a basis for mechanical system design have been specified by a manufacturer's name and model number. Where another manufacturer's product has been specified as an alternate to this equipment the proposed cost

for this alternate shall include all labor and materials that will be required to install the equipment and make it operate satisfactorily in accordance with the original design concept. The Contractor shall include such things as changes in piping, valves, supports and supporting structure, fittings, motors, controls, electrical wiring and thermal insulation. It shall be the responsibility of the Contractor to make certain the alternate equipment will fit into the designated spaces. He shall make the necessary field measurements in order to determine that there is adequate space for the equipment, taking into consideration the clearances that are required for connections and servicing.

1.25 ALIGNMENT:

A. Where several receptacles, devices, bells, alarms, thermostats, switches, handles, etc., are to be installed in a common location, this equipment shall be lined up in a vertical plane. It is the Contractor's responsibility to verify exact locations and alignment with the Architect in field prior to installation.

B. The Contractors shall carefully check all the Drawings and coordinate their work with all trades to provide for a symmetrical and coordinated ceiling. Ceiling T-bars, lights, registers, and other equipment shall all be symmetrically installed with provisions made for integrating the T-bars and this equipment. Failure to coordinate will result in relocation of ceiling components as directed by the Architect at the Contractor's expense.

1.26 OPERATION AND MAINTENANCE INSTRUCTIONS:

A. Refer to Division 01 for requirements in addition to the following:

1. The Contractor shall prepare for the Owner, 3 hard bound volumes, each containing all operating instructions and information necessary for the care and maintenance of the system. These volumes shall be complete in every respect, and shall include detailed operating instructions for each piece of equipment and diagrams for control wiring and piping so arranged and detailed that the maintenance staff may trace the control in the event of operational malfunctioning.
2. The Contractor shall submit 1 of the hard-bound volumes to the Architect for approval prior to presenting same to Owner.
3. The purpose of this manual is to assist the Owner in routine operation, maintenance, servicing, troubleshooting and procurement of replacement parts. All information in the manual shall be as-built and only material pertinent to the project shall be included.
4. The operating manual shall be considered a part of the final inspection and shall be submitted for approval at least 30 days in advance of a request for final inspection. The manual shall include:
    a. A copy of all final corrected equipment submittals, control diagrams, descriptive brochures, and a list of all parts of each piece of mechanical and electrical equipment which has been furnished and installed.
5. Complete and detailed typewritten operating and maintenance instructions for all major operating equipment. The operating and start-up instructions shall be written in a concise, step by step manner. Maintenance instructions shall include such things as periodic checks, adjustments and troubleshooting techniques.
6. A listing of all equipment, a compilation of the nameplate data for this same equipment, the name, address and telephone number of the nearest service organization.
    a. Copies of all A.S.M.E. pressure vessel certifications, state police approved tank permits, complete additional valve tag schedules, all electrical inspection permits and all additional mechanical and electrical permits required for occupancy by the Owner.

b. All of the materials shall be indexed, arranged categorically and be bound in a rigid, plastic covered, three ring binder.

7. The Contractor shall provide Project Records documents in accordance with requirements of Division 01.
8. O & M's must be provided once equipment is taken over by the Owner.
9. Warranty starts when Owner takes over that phase/space.

1.27 PAINTING:

A. Refer to Division 09 in addition to the following:

1. In exposed finish ceiling areas, clean and prep all piping for final paint finish. Protect all installed sprinkler heads with temporary coverings and remove coverings upon completion of painting. Refer to the Summary of Multiple Contract for designation of painting responsibilities.
2. Provide corrosion inhibiting prime coating on all ferrous materials installed on exterior of building. Coordinate color with Architect in field. Protect all building surfaces during painting of adjacent piping.
3. Paint all metal laid underground with one heavy coat of corrosion protective materials.
4. Unless specifically noted otherwise, insulation and galvanized piping in ceiling cavity area shall not be painted.

1.28 EARTHWORK:

A. Refer to Division 31 and drawing details for requirements in addition to the following:

1. Provide all excavating, backfilling, shoring, sheeting, pumping, bailing, etc., required for the installation of the Work of this Section.
2. Trench depths shall allow adequate cover over piping; walls shall be vertical and bottoms shall be instrument graded. Earth shall be scooped out under pipe hubs to provide a solid bearing for the barrel of the pipe on undisturbed earth. Concrete or other approved supports shall be provided for all pipes installed in fill.
3. Carry pipe trenches in rock below the pipe invert at least 1/4 the nominal diameter of the pipe or a minimum of 4" below the bottom of the pipe whichever is the greater. Refill space below pipe with crushed stone or gravel ranging in size from 1/4" to 3/4" and compacted as indicated in Div. 33 specifications.
4. Excavation under footings or foundations and deeper than the angle of repose from footings or foundations as determined by the Architect shall be backfilled solidly with 3,000-pound concrete, to such angle of repose and bottom of such footing or foundation. Where excavation damages existing lawns, sidewalks, roadways etc., such surfaces shall be restored to their original condition by the Contractor performing the excavation.
5. All excavated material remaining after the backfilling operation shall be removed from the site by this Contractor.
6. Any settlement in trench backfill shall be brought to grade, and damage to pavement or slabs caused by such settlement shall be repaired at the Contractor's expense.
7. All repair of macadam or concrete paving made necessary by work done under this contract shall be performed by General Contractor at the expense of this contractor. All such repairs shall match surrounding paving in materials and workmanship.

END OF SECTION 21.0100

SECTION 21.0500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fire Suppression system requirement for sprinkler systems.

B. Piping and Fittings

C. General Valves

1.2 RELATED REQUIREMENTS

A. Division 09 - Painting and Coating: Preparation and painting of fire protection piping systems.

B. Section 21.0553 - Identification for Fire Suppression Piping and Equipment: Piping identification.

C. Section 21.1300 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.

1.3 REFERENCE STANDARDS

A. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2026.

B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.

C. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2021.

D. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard; 2025.

E. ASME B16.9 - Factory-Made Wrought Buttwelding Fittings; 2024.

F. ASME B16.11 - Forged Fittings, Socket-Welding and Threaded; 2021.

G. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

H. ASME B16.25 - Buttwelding Ends; 2022.

I. ASME B36.10M - Welded and Seamless Wrought Steel Pipe; 2022.

J. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2025, with Errata.

K. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999 (Reapproved 2026).

L. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.

M. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe; 2021.

N. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2026.

O. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2025.

P. ASTM A536 - Standard Specification for Ductile Iron Castings; 2026a.

Q. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use; 2021.

R. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2026.

S. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2026.

T. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Amendment (2026).

U. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2021.

V. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2023.

W. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2023.

X. AWWA C606 - Grooved and Shouldered Joints; 2022.

Y. FM (AG) - FM Approval Guide; Current Edition.

Z. ITS (DIR) - Directory of Listed Products; Current Edition.

AA. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

BB. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems; 2024.

CC. UL (DIR) - Online Certifications Directory; Current Edition.

1.4 SUBMITTALS

A. See Division 01 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturers catalogue information. Clearly indicate exact models/model number, options, and accessories to be provided. Indicate applications where the submitted product is to be used. Indicate design pressure and ratings.

C. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

1. Grooved joint couplings and fittings shall be shown on drawings and product submittals and shall be specifically identified with the applicable Victaulic style or series number.

D. Project Record Documents: Record actual "as installed" locations of piping, sprinklers, components, and tag numbering and submit as "Record Set" after completion of all installation work.

E. Operation and Maintenance Data: Include installation instructions and spare parts lists.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Division 01 - Product Requirements, for additional provisions.
2. Extra Valve Stem Packings: Two for each type and size of valve.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.

B. Installer and Designer Qualifications: Company specializing in performing the work of this section with minimum 5 years experience. approved by manufacturer.

C. Conform to UL requirements.

D. Valves: Bear UL and FM label or marking. Provide manufacturer's name and pressure rating marked on valve body.

E. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

F. To assure uniformity and compatibility of piping components in grooved piping systems, all grooved products utilized shall be supplied by a single manufacturer. Grooving tools shall be supplied from the same manufacturer as the grooved components.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

1.7 EXTRA MATERIALS

A. Provide cabinet, wrench, and spare sprinkler heads (quantities in accordance with NFPA13.)

B. Provide two valve stem packings for each size and type of valve installed.

PART 2 - PRODUCTS

2.1 FIRE SUPPRESSION SYSTEMS

A. Sprinkler Systems: Conform work to NFPA 13, IBC, and IFC, requirements of the Local A.H.J., requirements of the Owners insurance carrier, and all additional minimum requirements as indicated on FP Drawings and Division 21 Specifications.

2.2 BURIED PIPING

A. Ductile Iron Pipe (3 in. and Larger): AWWA C151/A21.51 cement/mortar lined in accordance with AWWA C104/A21.4

1. Fittings: AWWA C110/A21.10 standard thickness.
2. Joints: AWWA C111/A21.11 rubber gasket.
3. Mechanically Restrained Couplings: Shaped composition sealing gasket, steel bolts, nuts, and washers.

2.3 ABOVE GROUND PIPING

A. Acceptable Manufacturers for Piping and Tubing:

1. Allied Tube - Sprinkler; 16100 S. Lathrop Avenue, Harvey, IL 60426.
2. Bull Moose Tube Company, 1819 Clarkson Rd., Chesterfield, MO 63017
3. Wheatland Tube Company; 900 Haddon Ave., Collingswood, NJ 08108-2162.

B. Wet pipe systems - Threaded and Welded Steel Pipe(limitted for use in sizes 2" and smaller): Schedule 40 Sprinkler Pipe: ASTM A795, Type E, Grade A. UL listed and FM approved for use as sprinkler piping. Black mill exterior coating and antimicrobial interior coating.

C. Wet pipe systems - Roll Grooved Steel Pipe (all sizes): Schedule 10 Sprinkler Pipe: ASTM A795, Type E, Grade A. UL listed and FM approved for use as sprinkler piping. Black mill exterior coating and antimicrobial interior coating.

D. Fittings:

1. All fittings shall be pressure rated for minimum 250 psig working pressure.
2. Welded Steel Fittings: ASME B16.9, wrought steel, buttwelded, ASTM A 234/A 234M, wrought carbon steel or alloy steel, or ASME B16.5, steel flanges and fittings. Welding Materials in accordance with ASME Code.
3. Threaded Malleable Iron Fittings: ASME B16.3, Class 300, threaded fittings.
4. Mechanical Grooved Fittings as manufactured by Victaulic ONLY: ASTM A536 ductile iron or ASTM A53 carbon steel fittings with grooved ends designed to accept Victaulic couplings. FireLock® or standard fittings.
5. Mechanical Grooved Couplings as manufactured by Victaulic ONLY: Ductile iron housing clamps with tapered seat to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
    a. Saddle type - U-bolt style hole cut Mechanical -T's shall not be permitted for use on this project. Hole cut Mechanical-T's shall be Victaulic Style 920 or 920N and installed in strict accordance with manufacturers instructions.
    b. Rigid Couplings: Housings shall be cast with offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with NFPA 13. Tongue and recess rigid type couplings shall only be permitted if the contractor uses a torque wrench for installation. Required torque shall be in accordance with the manufacturer's latest recommendations.
        1) 1-1/4” to 4”: “Installation Ready” stab-on design, for direct 'stab' installation onto grooved end pipe without prior field disassembly and no loose parts. Victaulic FireLock® EZ Style 009.
        2) 5” and Larger: Standard rigid coupling. Victaulic FireLock® Style 005 or Style 07 Zero-Flex®.
        3) Flexible Couplings: Use in seismic areas where required by NFPA 13.
            (a) 2” to 6”: “Installation Ready” stab-on design, for direct 'stab' installation onto grooved end pipe without prior field disassembly and no loose parts. Victaulic Style 177 QuickVic™.
            (b) 8” and Larger: Standard flexible coupling. Victaulic Style 75 or 77.
            (c) Coupling gaskets shall be listed for use as follows:
        4) Coupling gaskets shall be listed for use as follows:
            (a) Dry System(Ambient Temperature) - FlushSeal® or EZ Style 009 design, Grade EPDM, Type A
            (b) Dry Freezer Applications(-30°F to 0°F) - FlushSeal®, Grade L, Silicone
            (c) Wet System(Ambient Temperature) - C-Shape or EZ Style 009 design, Grade EPDM, Type A
    c. Flanged Adapters: ASTM A536 ductile iron casting, flat faced, designed for incorporating flanged components with ANSI Class 150 bolt-hole pattern. Victaulic Style 741.

2.4 PIPE HANGERS AND SUPPORTS

A. Acceptable Manufacturers for Piping Hangers and supports:

1. TOLCO Inc.

2. Grinnell
3. Provide hangers and supports as manufactured by the listed acceptable manufacturers or equal as approved by owner/architect.

B. Pipe Hangers: Adjustable swivel ring, MSS-SP-69 Type 10, Carbon steel, or Adjustable Clevis, MSS-SP-69 Type 1, Carbon steel.

1. Adjustable swivel ring: TOLCO Inc. - Fig.200 or equal.
2. Adjustable clevis: TOLCO Inc. - Fig.1 or equal.
   a. Provide bolt spacer in all applications where seismic restraint is required.

C. Armovers and end of branch: Adjustable swivel ring with surge restrainer, MSS-SP-69 Type 10

1. Adjustable swivel ring: TOLCO Inc. - Fig.200 or equal w/ Fig.25 surge Restrainer
2. Adjustable clevis: TOLCO Inc. - Fig.1 or equal.

D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

E. Wall Support: Welded steel bracket and wrought steel clamp.

F. Vertical Support: Steel riser clamp, MSS-SP-69 Type 8.

1. Steel Riser Clamp: TOLCO Inc. - Fig.6 or equal.

G. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

H. Structural Attachments

1. Reversible C-Type Beam Clamp, MSS-SP Type 19 - TOLCO Inc. Fig. 65 & Fig. 66 with Beam clamp retaining strap or equal as approved by Owner/Architect.
2. Bar Joist Hanger, TOLCO Inc. Fig. 61T (up to 4" pipe)
3. Threaded side Beam Bracket, TOLCO Inc. Fig. 58 (up to 4" pipe)
4. Provide additional steel to support work from structural framing members as required where support is required between framing members.

I. Victaulic Style 009, 005, and 07 rigid couplings, with angle-pattern bolt pads, may be used with IPS steel piping systems, which meet the support and hanging requirements of NFPA 13. An adequate number of Victaulic Style 177, 75 and 77 flexible couplings shall also be used to compensate for thermal expansion/contraction of the pipe.

2.5 GATE VALVES

A. 2-1/2 inch to 8 inch:

1. UL Listed FM approved, Iron body, bronze trim, , OS&Y rising stem pre-grooved for mounting tamper switch, handwheel, solid rubber covered bronze or cast iron wedge, flanged ends.
2. UL Listed FM approved, ductile iron body, bronze mounted, OS&Y brass rising stem, cast iron bonnet, EPDM coated cast iron disc, handwheel, groove x groove or groove x flanged ends, optional supervisory switch. Victaulic Series 771H or Series 771F.

2.6 GLOBE OR ANGLE VALVES

A. Up to and including 2 inches:

1. Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable rubber disc, threaded ends, with backseating capacity repackable under pressure.

B. Over 2 inches:

1. Iron body, bronze trim, rising stem, handwheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

2.7 BALL VALVES

A. Up to and including 2 inches:

1. Bronze two piece body, brass, chrome plated bronze, or stainless steel ball, teflon seats and stuffing box ring, lever handle and balancing stops, threaded ends with union.

B. Over 2 inches:

1. Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle or gear drive handwheel for sizes 10 inches and over, flanged.

2.8 BUTTERFLY VALVES

A. Bronze Body(up to 2 inches):

1. UL Listed, FM approved, Stainless steel disc, resilient replaceable seat, threaded or grooved ends, extended neck, handwheel and gear drive and integral indicating device and preinstalled supervisory switch.

B. Ductile Iron Body(up to 4 inches)

1. UL Listed, FM approved, Ductile iron body, nickel plated ductile iron disc, Nitrile seat, Type 416 stainless steel two-piece stem, TFE-lined stainless steel bearings, weather-proof actuator with pre-wired supervisory switches. Victaulic Series 765 (365 psi) and Series 705 (300 psi).

2.9 CHECK VALVES

A. 2 inch to 3 inch:

1. UL Listed, FM approved, ductile iron body, CF8M stainless steel disc, stainless steel spring, and brass shaft, nickel-plated seat with Nitrile o-ring, grooved ends, 365 psig maximum pressure rating. Victaulic Series 717H.

B. 4 inch to 12 inch:

1. UL Listed, FM approved, ductile iron body, EPDM coated ductile iron disc, stainless steel spring and shaft, welded-in nickel seat, grooved ends, 300 psig maximum pressure rating. Victaulic Series 717.

2.10 DRAIN VALVES

A. Ball Valve:

1. UL Listed, FM approved, Brass with cap and chain, 3/4 inch hose thread.

2.11 SLEEVES:

A. Sleeves through foundation walls shall be preassembled "Link-Seals" as manufactured by Thunderline Corporation, 5495 Treadwell, Wayne, Michigan 48184.

B. Sleeves in bearing and masonry walls shall be made of standard weight steel pipe.

C. Sleeves through concrete floor slabs and other partitions shall be No. 2 U.S.S. gauge sheet metal.

D. Unless otherwise specified or shown, sleeves shall be two pipe size larger than the overall outside diameter of the pipe when insulated.

2.12 ESCUTCHEONS:

A. Solid pattern, heavy ceiling floor or wall escutcheons. Steel or Malleable iron with set screw. Prime coated ready for painting.

B. Pressed brass, chromium plated, solid-type escutcheons.

2.13 ACCESS DOORS AND PANELS:

A. Refer to Division 01 for requirements in addition to the following:

B. Panels shall be of suitable size and construction for each specific location. All assemblies in painted wall or ceiling applications shall be rustproof and exposed finished edges and surfaces shall be prime-coated with rust inhibitive paint. All assemblies in tiled wall construction shall be stainless steel. Doors shall be flush and shall open 175 degrees on concealed hinges. Doors to be installed in ceilings shall be with screw driver operated cam locks. Doors for wall installation shall have master-keyed cylinder locks. Doors shall be Milcor, or equal, as follows:

	Construction	Milcor Model
a.	Masonry	Style M
b.	Plaster	Style K

2.14 ANCHOR BOLTS:

A. Anchor bolts must be of the hook type and of the proper sizes and length to suit the apparatus. The bolts shall be set in pipe sleeves of approximately twice the bolt diameter and as long as the imbedded length of the bolt.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13 and the additional requirements below.

1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
2. Place hangers within 12 inches of each horizontal elbow.
3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
4. Support vertical piping at every other floor. Provide one riser support on each floor where grooved piping is used. Support riser piping independently of connected horizontal piping.

5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
6. Provide additional supports as follows:
    a. Provide minimum of two hangers on any grooved piping exceeding 11ft. in length.
    b. Provide additional steel as required to span structural members for intermediate support of piping required between structural framing members. ALL piping shall be supported from structural framing members only. Coordinate all work with other trades.
        1) Do not fasten or anchor work to concrete deck except where individually approved by Structural Engineer and Architect.
        2) Do not fasten or anchor any work directly to metal roof deck.

B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

C. Install piping to conserve building space, to not interfere with use of space and work of other trades.

D. Group piping whenever practical at common elevations.

E. Provide sleeves when penetrating footings, floors, and walls and fill annular space between piping and sleeves.

1. Where pipes pass through waterproofed floor or walls, design of sleeves shall be such that the waterproofing can be properly flashed around the sleeves, and of such height that the water will be restrained from entering sleeves and dripping to any finished areas below.

2. Where pipes pass through fire resisting portions of the structure, the annular space between the sleeve and the pipe shall be filled with an approved UL Listed fireproof material. The entire penetration assembly shall be UL Listed to achieve fire resistance equivalent to fire separation required for the wall or floor.

F. Provide escutcheons on all exposed pipes, except as otherwise described, passing through walls, floors, ceilings, etc. in finished spaces. Escutcheons will not be required where sleeves intentionally extend above finished floor.

G. Install valves, specialties, and other serviceable items within accessible spaces. Provide access panels where valves, specialties, and other serviceable items are required to be installed behind plaster, tile, or similar type non-removable surfaces. Coordinate panel installation with G.C. in field.

H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

I. Perform welding In accordance with ASME Code.

J. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

K. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding. Refer to Section 09 9000.

L. Do not penetrate building structural members unless indicated or as approved in field by Structural Engineer.

M. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

N. Install valves with stems upright or horizontal, not inverted. Remove protective coatings prior to installation.

O. Provide OS&Y gate or butterfly valves for shut-off or isolating service.

P. Provide drain valves at main shut-off valves, low points of piping and apparatus.

Q. Provide all concrete bases, reinforcing, etc. required to install the work of this section, unless otherwise noted. Prior to installing any forms, reinforcing or concrete, notify all other Contractors or subcontractors, in ample time for them to install any portion of their work which is to be concealed in the concrete.

R. Provide all necessary anchor bolts as required for the various equipment specified herein, and set in place at the time the foundations, bases, or curbs are poured. Fill all spaces between the bolt sleeves, rough foundations, bases or curbs of the equipment with one inch of non shrinking cement grout. Each Contractor shall assume all responsibility for the location of all anchor bolts for the equipment furnished by him under these Specifications, and must have a man present at the time the foundation, bases, or curbs are poured.

END OF SECTION 21.0500

SECTION 21.0548 - VIBRATION ISOLATION & SEISMIC MOUNTINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Seismic Restraint & Mountings

B. Vibration Isolation

1.2 SUMMARY

A. The extent of seismic restraint and mounting work are indicated by drawings and schedules by requirements of this section to include:

1. Restraints for Motor Driven Equipment.
2. Restraints for piping and piping risers.
3. Flexible connections for piping at Equipment.
4. The Contractor shall employ the services of a licensed Professional Engineer registered in the State of Delaware to design, submit, and supervise the installation of seismic restraining and mountings products applicable to all equipment and piping systems installed by the Contractor.

B. The extent of vibration isolation are indicated by Drawings and schedules and by requirements of this Section to include:

1. Vibration Isolation for Motor Driven Equipment.
2. Vibration Isolation for piping and piping risers.
3. Flexible connections for piping at Equipment.

1.3 SUBMITTALS

A. Refer to Division 01 Specifications for submittal procedures

B. The Manufacturer of seismic restraints products shall submit the following data clearly marked on the submittal drawing. Each piece of isolated equipment shall be clearly identified, as well as the quantity and type of vibration isolators and seismic restraints.

C. Weight and center of gravity of each piece of isolation equipment, and RPM of each piece of rotating isolated equipment. When equipment center of gravity is not available, assumed locations for center of gravity shall be identified in submittals.

1. Calculated static load on each isolator.
2. Calculated deflection for each piece of isolated equipment.
3. Calculated seismic loads, for each restraint including horizontal and vertical forces and overturning moments.

D. Submittals for bases shall clearly identify locations for all mountings, as well as all locations for attachment points of the equipment to be mounting base. Installation instructions shall be included.

E. Submittals shall include seismic calculations signed and checked by qualified licensed Engineers in the employ of the Manufacturer of the vibration isolators. Catalog cut sheets shall be included for each type of mounting used on equipment being isolated.

1. Manufacturer's certification of components seismic acceleration operational capacity and attachment.

1.4 QUALITY ASSURANCE

A. Product Qualification: Provide each type of seismic mounting unit produced by a specialized manufacturer, with not less than 5 years successful experience in the production of units similar to those for the project.

B. Except as otherwise indicated obtain support isolation units from a single manufacturer.

C. Engage the manufacturer to provide technical supervision of the installation of restraints produced by him, and of associated inertia bases.

D. Manufacturer: Provide Seismic mounting units manufactured by the following:

1. Amber/Booth
2. Consolidated Kinetics Corp.
3. Vibration Mountings and Controls, Inc./Korfund Dynamics
4. Mason Industries
5. Vibration Eliminator Co.

E. Manufacturer: Provide Vibration Isolation manufactured by the following:

1. Amber/Booth
2. Consolidated Kinetics Corp.
3. Vibration Mountings and Controls, Inc./Korfund Dynamics
4. Mason Industries

F. After installation is complete and while the system is operating, the vibration isolation Manufacturer and/or his qualified Representative shall conduct an inspection of the installation with the Contractor. The Representative will submit a written inspection report detailing any discrepancies, the Representative shall submit a report so stating. If there are discrepancies, the report shall detail corrective work to be done.

G. Submit detailed seismic drawings, drawn to the scale indicated, for each of the following installations. All seismic drawings shall be based on the Architectural and Structural Contract Drawings. All seismic drawings shall bear the stamp of a Professional Engineer licensed in the state of the Project site:

1. Mechanical Equipment rooms depicting size and location of concrete housekeeping pads and the location and type of seismic restraints. Minimum Scale: 1/4"=1'-0".
2. Piping Plans depicting location and type of seismic restraints. Minimum Scale: 1/8"=1'-0".
3. Concrete pad details depicting location and size of reinforcing, doweling, and anchor bolts for each specific piece of equipment. Minimum Scale: 1/2"=1'-0".
4. Suspended equipment depicting restraint locations, types, and methods of attachment. Minimum Scale: 1/8"=1'-0".
5. Miscellaneous Attachment Details depicting size, locations, and types of attachment (i.e., bolts, welds, anchors, cables) for securing equipment to seismic mountings and for securing seismic mountings to the building structure.

H. Submit a seismic design errors and omissions insurance certificate. (Manufacturers product liability insurance certificates are not acceptable.

1.5 DESIGN - VIBRATION ISOLATION SYSTEMS

A. Vibration isolators shall be selected based on known or estimated operating weight distributions of the isolated equipment, with the quantity and location as shown on the components Drawings. Isolator type shall be tabulated for each isolated piece of equipment.

B. Isolators shall have either known non-deflected heights of spring element or calibration markings so that, after adjustment, when carrying their load, the deflection under load can be verified to determine if the load is within the proper range of the isolator and if the correct degree of vibration isolation is being provided.

C. Isolators shall function in the linear portion of the load versus deflection curve. Theoretical vertical natural frequency shall not differ from the design objectives by more than +10%.

D. Vibration isolation available internal to the equipment shall not be considered equivalent, and may only be used where it can be shown not to compromise the strength or performance of the entire system.

E. Unless otherwise specified, all isolated equipment and all piping shall be seismically restrained in accordance with requirements contained herein. All un-isolated mechanical equipment shall be adequately secured to the structure.

F. Unless the equipment incorporates unit construction using an integral unit frame or is specified otherwise, each item of mechanical equipment, along with its drive unit, shall be mounted on a rigid steel or steel and concrete base. The equipment, including the base, shall be mounted on, or suspended from, vibration isolators to prevent the transmission of vibration and mechanically transmitted structure borne sound to the supporting structure.

G. Isolation hangers shall be used for all piping in equipment rooms or for 50 ft. from vibration equipment, whichever is greater. To avoid reducing the effectiveness of equipment isolators, at least three of the first hangers from the equipment should provide the same deflection as the equipment isolators, with a maximum limitation of 2 inch deflection. The remaining hangers shall be spring or combination spring and rubber with a minimum of 0.75 in deflection. To prevent load transfer to the equipment flanges when the piping system is filled, the first three hangers adjacent to the equipment shall be the positioning type (specification type 5). Floor supports for piping in equipment rooms and adjacent to isolated equipment shall use restrained vibration isolators. They should be selected according to the guidelines for hangers.

1.6 DESIGN - SEISMIC RESTRAINTS

A. The site is classified as follows: Design Category "C"; International Building Code 2015 and ASCE 7-10 Table 11.6-1 & Pg. 56

B. The Building Occupancy Risk Category is Category IV *(Hospital, Emergency Response, Fire, Police)* per ASCE 7-10 Table 1.5-1 Pg. 2.

C. Seismic restraint shall be required for the following installations:

1. *(Seismic Design Category C - Risk Category IV)* All Fire Protection Eqipment and piping systems

D. Internally isolated equipment in lieu of specified isolation and restraint system must include certification by the equipment manufacturer that the internal isolation system meets the specified isolation and system restraint criteria. Equipment resiliently mounted on spring or pad type isolators shall be provided with seismic restraints or snubbers. Where required by code, seismic restraints for equipment mounted on vibration isolated curbs shall consist of slack galvanized or stainless steel cables (Type 16), attached to a structurally sound element of the equipment.

E. Each piece of isolated equipment shall receive a minimum of four all-directional restraint/snubbers, located as close to the equipment corners as practical. These shall consist of either restrained isolators or free standing isolators with separate snubbers. All snubbers shall have an impact surface consisting of a high quality elastomer. The elastomer shall be easy to inspect for damage, shall be replaceable and shall be a minimum of 3/4 inch thick.

F. Calculations by the Manufacturer's qualified licensed Engineer substantiating the mounting system, seismic restraints and recommended anchor bolts shall be submitted for approval along with the mechanical Drawings. Minimum spacing of anchor bolts, as well as location from edges of structure or concrete, shall be identified.

G. Unless otherwise specified, all equipment piping shall be restrained to resist seismic forces. Restraints shall maintain mechanical equipment or piping in a captive position. Restraint devices shall be designed and selected to meet seismic requirements as defined in the latest issue of IBC.

H. Anchor bolt calculations, signed by a qualified licensed Engineer, shall be submitted showing adequacy of bolt sizing and type. Calculations shall be furnished for anchors on restraint devices, cables, isolated and rigidly mounted equipment. Calculations shall specify anchor bolt type, embedment, concrete compressive strength, minimum spacing between anchors, and minimum distances of anchors from concrete edges. Concrete anchor locations shall not be near edges, stress joints, or an existing fracture. Embedded bolt locations and spacing shall conform to IBC 2006. All bolt shall be ASTM A307 or better.

PART 2 - PRODUCTS

2.1 GENERAL

A. Unless otherwise specified, all hardware shall be stainless steel or zinc plated. Springs with a deflection of up to 2-inches shall be zinc plated, or coated with a polyester epoxy powder. Springs with a rated deflection capability greater than 2-inches may be painted. Zinc plating shall conform to ASTM B633, Class 2 SC2, minimum.

2.2 TYPE 7 MOUNTINGS - PRE-COMPRESSED HANGERS

A. Spring-Flex hangers shall consist of a color coded steel spring in series with a neoprene element molded in specific colors for proper identification of rated load capacity. Springs shall be pre-compressed to the rated deflection so as to support the suspended equipment or piping at a fixed elevation during installation regardless of load changes. For 30 degree misalignment capability, spring diameters and hanger box lower hole sizes shall be of sufficient size to permit the hanger rod to swing approximately 30 degrees before contacting the box.

B. Springs shall be coated with a polyester epoxy powder. Hardware shall be stainless steel, or zinc plated. Steel housings shall be painted or galvanized.

C. Spring-Flex hangers shall be Series RSHPR or RSHPR-30A for 30 degree misalignment capability, as manufactured by Vibration Mountings and Controls, Inc.

2.3 TYPE 8 MOUNTINGS - SPRING HANGERS

A. Spring-Flex hangers shall consist of a color coded steel spring with a neoprene and steel washer which will properly distribute the load on the spring. For 30 degree misalignment capability, spring diameters

and hanger box lower hole sizes shall be of sufficient size to permit the hanger rod to swing approximately 30 degrees before contacting the box. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Hangers where are to be used with flat iron duct straps will be provided with eye bolts on both ends.

B. Springs shall be coated with a polyester epoxy powder. Hardware shall be stainless steel, or zinc plated. Steel housings shall be painted or galvanized.

C. Spring-Flex hangers shall be Series SH or SH-30A for 30 degree misalignment capability, as manufactured by Vibration Mountings and Controls, Inc. Hangers with eyebolts to be Type SHSC or SHSC-30A for 30 degree misalignment capability, as manufactured by Vibration Mountings and Controls, Inc.

2.4 TYPE 10 MOUNTINGS - FLOOR, WALL, AND CEILING SLEEVES

A. Where piping passes through walls, floors, or ceilings, a vibration control sleeve shall be provided to reduce the transmission of vibration. The sleeve shall consist of two pipe halves with neoprene sponge material bonded to the inside and a bolting arrangement for secure fit around piping. Where temperature exceeds 240 degrees F., an appropriate density fiberglass shall be used in place of neoprene material.

B. Sleeve shall be type VCS as manufactured by Vibration Mountings and Controls, Inc.

2.5 TYPE 11 MOUNTINGS - RESILIENT PIPE GUIDES

A. Where vertical piping runs between support points, a resilient pipe guide shall be provided. The guide shall consist of an angle frame and four double deflection neoprene mountings molded in specific colors for proper identification of rated load capacity.

B. Resilient Pipe Guide shall be type RPG as manufactured by Vibration Mountings and Controls, Inc.

2.6 TYPE 12 MOUNTINGS - PIPE ANCHORS:

A. Multi-directional pipe anchor shall consist of suitable steel sections in series with heavy duty duck and neoprene material assembled in a telescopic housing to provide the necessary restraint in both the vertical and horizontal directions. Pipe anchor shall be sized to limit load on neoprene and duck material to 500 psi.

B. Multi-directional Pipe Anchor shall be type MDPA as manufactured by Vibration Mountings and Controls, Inc.

2.7 TYPE 13 - FLEXIBLE CONNECTORS

A. Install Quiet-Sphere Flexible Connectors at the suction and discharge of each pump. The connectors shall be molded in spherical design of multiple layers of neoprene and synthetic fiber with integral corrosion resistant plate steel flanges. The connectors shall be suitable for pressures up to 214 psi and temperatures up to 240 degrees F. Where piping is not anchored, control rods must be installed at each connector to limit movement within their specified limits.

B. Flexible connectors shall be Quiet-Sphere Type VMS, VMT, or VMU as manufactured by Vibration Mountings & Controls, Inc.

2.8 TYPE 14 - SEISMIC SPRINGS WITH INTERNAL RESTRAINTS

A. Steel spring isolator incorporating elastomeric snubbing in all directions. The snubber shall be adjustable in the vertical direction and allow a maximum of 1/4 inch travel in all directions before contacting the elastomer cushion.

B. Spring diameter shall be no less than 0.8 times the compressed height of the spring at rated load. Springs shall also have a minimum additional travel to solid equal to 50% of the rated deflection.

C. Housing shall have provision to adjust the rebound plate and to inspect the spring. Housing shall be of cast ductile iron, malleable cast iron or of welded steel construction. Gray iron casings are not permitted.

D. Springs shall be color coded for proper identification of rated load capacity. Springs shall be coated with a polyester epoxy powder. Hardware shall be stainless steel, or zinc plated.

E. Mounting shall be Series AEQM or AWMR as manufactured by Vibration Mountings & Controls, Inc.

2.9 TYPE 15 - SEISMIC SNUBBERS/RESTRAINTS

A. All-directional Seismic Snubbers shall include all directional elastomer elements, having a minimum elastomer thickness of 3/4 inch in all directions. Elastomers shall be easy to inspect and shall consist of replaceable elastomer inserts. Elastomer shall be neoprene or a high quality rubber including anti-ozone and anti-oxidant materials. For installations where the expected temperature range is -20 degrees F. to +180 degrees F., the elastomer shall be neoprene conforming to either:

1. ASTM D2000 Grade 2BC; or Bridge Bearing Neoprene.

B. For installations where the expected operating temperature range can be as low as -65 degrees F. or a high as +300 degrees F., the elastomer shall be Ethylene Propylene Diene Monomer (EPDM) conforming to ASTM D2000.

C. Snubbers shall be manufactured with an air gap between steel and elastomer of 1/8 inch to 1/4 inch. Snubbers shall be installed with factory set clearances.

D. Snubber must have at least two anchor bolt holes and shall have an ultimate load capacity of at least four times the rated static load capacity.

E. Seismic Snubber shall be Seismic Restraint Series SR/SRD as manufactured by Vibration Mountings & Controls, Inc.

2.10 TYPE 16 - CABLE RESTRAINTS

A. Steel aircraft cable restraints are designed and installed to limit motion on suspended isolated equipment, piping or ducting. Cables are installed with enough slack to engage only when 1/4 movement occurs. On suspended equipment, cables are installed in sets of four, located at 45 degree angles to all three axes. Where required at pipe hangers, cables are placed two at each location, alternating orientation at successive locations.

B. Cables shall be 7 x 19 galvanized or stainless steel aircraft cable conforming to FED-STD-RR-W-410D. Cable diameters shall be available in at least three sizes to provide cost effective method of support for a wide range of supported loads.

C. Seismic cable restraints shall be Series SCR as manufactured by Vibration Mountings & Controls, Inc.

2.11 TYPE 17 - ELASTOMER MOUNTINGS

A. Consists of a captive elastomeric mount molded from neoprene or EPDM compound conforming to the requirements of ASTM D2000. Load bearing elastomer element shall be housed in either a heat treated cast aluminum housing or machined structural plate.

B. Mount shall incorporate a fail-safe captive design, and shall provide a vertical natural frequency of 15 Hz to 25 Hz, depending upon the static load. Mount shall be capable of providing dynamic deflections of up to .12 inches.

C. Use Vibration Mountings & Controls Series RB1, RB3 or RB4 with structural plate or MB1 or MB3 (aluminum housing).

PART 3 - EXECUTION

3.1 PERFORMANCE OF SEISMIC RESTRAINTS

A. The manufacturer shall warrant the selection, sizing, and application of all seismic restraints for each application.

B. The seismic engineer shall supervise and review the installation of all seismic restraints.

3.2 APPLICATIONS

A. General: Except as otherwise indicated, apply the following types of vibration isolators and seismic restraints for the indicated items of Equipment.

3.3 SEISMIC RESTRAINT SCHEDULE

A. Piping Restraints: Applicable for threaded, welded, soldered, and grooved piping; schedule 10, 20, 40 and 80: Install cable restraints at maximum intervals of 40 ft. for transverse bracing and 80 ft. for longitudinal bracing, and at each change in direction. Actual spacing shall be determined by the seismic engineer.

B. Flexible Pipe Connectors: Install in piping systems at the following locations:

1. Connections, 3/4" pipe size and larger, with vibration isolation mounted equipment.

3.4 INSTALLATION

A. Seismic restraint systems shall be installed in strict accordance with the Manufacturer's written instructions and submittal data.

B. For Seismic installations, all floor mounted equipment, whether isolated or not, shall be bolted or welded to the structure to resist seismic forces. Bolt attachments, diameter of inserts, embedment depth and weld length as shown on approved submittal Drawings, shall be followed in all respects.

C. Seismic restraints shall be installed after equipment is in operating position to assure design clearances are maintained.

3.5 NOISE AND VIBRATION

A. Particular care shall be exercised in the selection and installation of all Mechanical Equipment and components to attain reasonable noise levels in occupied spaces. In general, sound levels for various spaces shall be maintained in accordance with the recommendations of the ASHRAE Guide. Normally

the classification of noise shall be by mutual agreement but should a dispute arise regarding sound levels after occupancy of the building, representative sound measurements shall be taken to determine the average noise level in the offending space.

3.6 SOUND ISOLATION

A. All Equipment and piping shall be installed so that no noise or vibration is transmitted to any part of the building beyond the room or rooms in which such noise or vibration is generating. Moving equipment shall be isolated from the concrete foundations or floors by cork where required to prevent transmission of noise of vibration.

B. Silencers shall be installed in water connections to quick closing devices. Shock absorbers shall be used in all pipe lines where required to eliminate noise.

C. Any and all other insulation or isolation required to accomplish the results specified above shall be furnished and installed without additional cost to the Owner.

3.7 INSPECTION

A. Upon completion of installation of all vibration isolation and seismic restraint devices, a certification report prepared by the Seismic Engineer shall be submitted in writing to the contractor indicating that all systems are installed properly and in compliance with the specifications. The report must identify those areas that require corrective measures or certify that none exists. Any field coordination type changes to the originally submitted seismic restraint designs must be clearly defined and detailed in the report.

END OF SECTION 21.0548

SECTION 21.0553 - IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe Markers.

1.2 RELATED REQUIREMENTS

A. Section 09 9000 - Painting and Coating: Identification painting.

1.3 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.1 GENERAL

A. Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified or schedule. Provide numbers, lettering and working as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.

B. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples: (Standpipe F12)

C. Manufacturers

1. Advanced Graphic Engraving: www.advancedgraphicengraving.com.
2. Brady Corporation: www.bradycorp.com.
3. Brimar Industries: www.brimar.com

4. Champion America, Inc: www.Champion-America.com.
5. Kolbi Pipe Markers: www.kolbipipemarkers.com
6. Seton Identification Products: www.seton.com/aec.

2.2 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.

1. Letter Color: White.
2. Letter Height: 1/4 inch.
3. Background Color: Black.

2.3 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter. Minimum information indicating fluid being conveyed(FP) and FP Zone where appropriate.

B. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.4 STENCILS

A. Stencils: With clean cut symbols and letters of following size:

1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.
2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.
3. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.
4. 8 to 10 inch Outside Diameter of Insulation or Pipe: 24 inch long color field, 2-1/2 inch high letters.

B. Stencil Paint: As specified in Section 09 9000, semi-gloss enamel, colors conforming to ASME A13.1.

2.5 PIPE MARKERS

A. Color: Conform to ASME A13.1.

1. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

2.6 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

B. Color code as follows:

1. Sprinkler Valves: Black.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Div.1 specifications for stencil painting.

3.2 INSTALLATION

A. Attach nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Attach tags to all valves with corrosion resistant chain.

C. Provide additional labelling including but not limited equipment tags, room labels, etc., for location of equipment and valving as required by the Authority Having Jurisdiction. Coordinate work with Architect in field.

D. Provide riser tags including hydraulic calculation information at all riser alarm valves and floor control assemblies.

E. Identify equipment with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.

F. Identify valves in main and branch piping with tags. Identify auxiliary drains and any piping specialty required for maintenance and operation of the system with nameplates indicating the function of the specialty.

G. Tag automatic controls, instruments, and relays. Key to control schematic.

H. Identify piping, concealed or exposed, with plastic pipe markers or Stencil painting (permitted within mechanical spaces). Verify requirements for exposed piping identification in finished areas with Architect in field. Identify service and flow direction. Install in clear view and align with axis of piping. Locate identification on horizontal piping not to exceed 20 feet on straight runs and at each side of penetration of structure or enclosure. Locate additional identification on risers and drops, adjacent to each Tee of main piping, and at each obstruction.

1. Install plastic pipe markers in accordance with manufacturer's instructions.
2. Apply stencil painting in accordance with Div. 1 specifications.

I. Locate ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 21.0553

SECTION 21.1300 - FIRE-SUPPRESSION SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wet-pipe sprinkler system

B. System design, installation, and certification.

C. Sprinkler Heads and Accessories

D. Sprinkler Alarm Valves

E. Supervisory and Monitoring Devices

F. Sprinkler System Fire Department Connections

G. Sprinkler System Accessories and Equipment

1.2 RELATED REQUIREMENTS

A. Section 07 8413 - Penetration Fireproofing

B. Section 21 0500 - Common Work Results for Fire Suppression.

C. Section 21 0553 - Identification for Fire Suppression Piping and Equipment.

D. Section 26 2717 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.

B. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association; 2016.

C. IBC

D. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.4 SUBMITTALS

A. See Division 01 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturers data on all products specified within this section including sprinklers, valves, and specialties. Clearly Indicate exact models/model numbers, options, and accessories to be provided. Indicate the application where the materials are to be used where appropriate. Manufacturers data shall include the following information as appropriate for each product: product listings (UL, FM, ASSE, etc.) performance ratings, rough-in details, weights, support requirements, and piping connections.

C. System Drawings:

1. Contractor shall prepare drawing submittals and hydraulic calculations for submittal to the Architect/Engineer, all local reviewing agencies having jurisdiction, and the owner's insurance carrier (I.S.O submittal necessary only when required by owner's insurance carrier). The shop drawings prepared by the contractor shall bear a fire protection engineer's seal, whom is registered in the Commonwealth of Pennsylvania. No work shall begin until all approvals are granted.
2. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
3. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls.
4. Submit shop drawings to authority having jurisdiction, and Fire Marshall for approval. Submit proof of approval to Architect.
5. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.
6. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.
7. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.
8. Maintenance Materials: Furnish the following spare equipment for Owner's use in maintenance of project.
    a. Extra Sprinklers: Type and size matching those installed, in quantity required by referenced NFPA design and installation standard.
    b. Sprinkler Wrenches: For each sprinkler type.
9. Sprinklers shall be referred to on drawings, submittals and other documentation, by the sprinkler identification or Model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.

1.5 QUALITY ASSURANCE

A. Maintain one copy of referenced design and installation standard on site.

1. Conform to UL requirements.
2. Designer Qualifications: Design system under direct supervision of a Professional Fire Protection Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
3. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
4. Installer and Designer Qualifications: Company specializing in performing the work of this section with working knowledge of NFPA13 installation requirements with minimum 5 years experience with fire protection systems similar to that required by this project. The
5. Equipment and Components: Provide products that bear UL label or marking.
6. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

7. To assure uniformity and compatibility of piping components in grooved piping systems, all grooved products utilized shall be supplied by a single manufacturer. Grooving tools shall be supplied from the same manufacturer as the grooved components.

8. To assure uniformity and compatibility of sprinklers within the fire protection system, all sprinkler heads shall be supplied by a single manufacturer.
9. To assure uniformity and compatibility of piping specialties within the Fire Protection system, all products within each of the product families specified below shall be supplied by a single manufacturer.

1.6 PRE-DESIGN MEETING

A. Coordinate and convene meeting before starting work of this section. Meeting shall include representation from Fire Protection Contractor, Architect, Engineer, AHJ. Meeting shall review general design requirements, submittal requirements, procedures for field coordination with Architect, and field coordination items for local AHJ review.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.8 TESTING

A. Perform and document testing in accordance with NFPA-13, NFPA-24, and the local Authority Having Jurisdiction.

B. Testing shall be witnessed by the local Authority Having Jurisdiction and owners representative. Coordinate scheduling of testing to allow attendance by all required representatives.

1.9 EXTRA MATERIALS

A. Provide extra sprinklers of type and size matching those installed, in quantity required by referenced NFPA design and installation standard.

B. Provide suitable wrenches for each sprinkler type.

C. Provide metal storage cabinet for spare sprinklers adjacent to main service entrance. Verify exact location with Owner Representative in field.

PART 2 - PRODUCTS

2.1 SPRINKLER SYSTEM

A. Provide a “Design Build” Fire Suppression Sprinkler/Standpipe System in accordance with ICC (IBC) and NFPA 13&14 (latest edition), and inclusive of all additional requirements as indicated on the drawings and in these specifications. The entire building shall be "sprinklered throughout" with "Quick Response" standard coverage sprinklers. No Extended coverage heads shall be permitted except where specifically noted on the Fire Protection drawings. The Fire Suppression Sprinkler System shall be hydraulically calculated to provide the prescribed density uniformly over the most remote area in accordance with NFPA13 and include a minimum 10psi safety factor. Provide Manual Wet standpipes in all stair towers indicated on drawings

1. Occupancy: Building predominantly Light Hazard, some areas of other classification in accordance with NFPA 13 and document drawings.
2. Water Supply:

a. Date: March 19, 2026 at 1:30 PM
   1) Monitor Hydrant: Hydrant #8-58 @ Fayette St. & 11th St.
      (a) Static pressure: 125 psi
      (b) Residual pressure: 120 psi
   2) Flow Hydrant: Hydrant #8-17 @ Fayette St. & 9th St.
      (a) Flow: 1706gpm@ 89psi pitot pressure

b. The above flow test information is provided as basis of design for the contract documents. The fire protection contractor shall perform a water flow test at time he is preparing his hydraulic calculations and use the results of his flow test as the basis for design of the "Design Build" sprinkler system.

B. Interface system with building control system.

C. Provide Wet Manual Standpipes with hose connection valves where indicated on the FP drawings. Provide hose connection valves within recessed Cabinets. Refer to drawings for locations.

D. Provide Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

2.2 WATER FLOW TEST

A. Perform a new water flow test before preparing hydraulic calculations and use the results of this flow test as the basis for design of the sprinkler system.

B. Submit water flow test data with Hydraulic Calculations

2.3 SPRINKLER HEADS AND ACCESSORIES

A. Acceptable Manufacturers

1. All sprinkler heads shall be provided by from a single manufacturer.
2. Viking Corporation.
3. Victaulic.
4. Tyco.

B. General:

1. UL and FM approved. Die-cast brass frame to 65-30, bronze upright or pendant deflector, beryllium nickel spring, with stainless steel lodgment spring and Teflon tape seal. Glycerin filled glass bulb, rated for working pressure to 175 psi . Where corrosion resistant construction is required by specifications or drawings, body shall be coated with UL listed and FM approved anti-corrosion nickel Teflon coating, (VC-250 - silver coloring). The sprinkler body shall be cast with hex shaped wrench boss to reduce the risk of damage during installation. Sprinklers can be ordered with NPT or IGS grooved connections. Sprinklers shall not contain rubber O-rings. Quick response type.

C. Concealed Pendant Type (with push on cover plate Suspended Ceiling Type for ACT, GWB, and other finished ceiling types) - Quick Response:

1. Finish: Brass. (Provide Nickel Teflon coated sprinkler heads where corrosion resistant heads are required and as noted on plans)
2. Cover Plate Finish/color: Color/Finish as selected by Architect from manufacturers full line of avialable color/finishes. Coordinate with Architectural ceiling plans and verify color selection in

field with Architect prior to order and Installation. Where custom color is indicated, provide custom color as selected by Architect.

3. Fusible Link: Glass bulb type temperature rated for specific area hazard. Contractor shall verify proper temperature selection in accordance with NFPA13 and coordination with any heat producing equipment located in close proximity to the sprinkler head.
4. Design Basis: Victaulic Model V38 series (Quick Response).

D. Dry Concealed Pendant Type (with matching push on escutcheon plate Suspended Ceiling Type for ACT, GWB, and other finished ceiling types) - Quick Response:

1. Finish: Brass. (Provide Nickel Teflon coated sprinkler heads where corrosion resistant heads are required and as noted on plans)
2. Escutcheon Plate Finish: Enamel, color as selected by Architect. Verify color selection in field with Architect prior to order and Installation.
3. Fusible Link: Glass bulb type temperature rated for specific area hazard. Contractor shall verify proper temperature selection in accordance with NFPA13 and coordination with any heat producing equipment located in close proximity to the sprinkler head.
4. Galvanized steel dry barrel with stainless steel inner tube
5. Design Basis: Victaulic Model V33 series (Quick Response).

E. Dry, Flexible Style, Concealed Pendent/ Pendent/ Horizontal Sidewall Type (with matching push on escutcheon plate Suspended Ceiling Type for ACT, GWB, and other finished ceiling types) - Quick Response:

1. Finish: Brass. (Provide Nickel Teflon coated sprinkler heads where corrosion resistant heads are required and as noted on plans)
2. Escutcheon Plate Finish: Enamel, color as selected by Architect. Verify color selection in field with Architect prior to order and Installation.
3. Fusible Link: Glass bulb type temperature rated for specific area hazard. Contractor shall verify proper temperature selection in accordance with NFPA13 and coordination with any heat producing equipment located in close proximity to the sprinkler head.
4. Flexible hose: UL listed FM approved SS braided hose
5. Design Basis: Victaulic Model V35 series (Quick Response).

F. Standard Upright or Pendent type, with guard (Exposed Sprinkler Areas) - Quick Response

1. Finish: Brass. (Provide Nickel Teflon coated sprinkler heads where corrosion resistant heads are required and as noted on plans)
2. Fusible Link: Glass bulb type temperature rated for specific area hazard. Contractor shall verify proper temperature selection in accordance with NFPA13 and coordination with any heat producing equipment located in close proximity to the sprinkler head.
3. Design Basis: Victaulic Model V27 series (Quick Response).

G. Dry Standard Upright, with guard (Exposed Sprinkler Areas) - Quick Response

1. Finish: Brass. (Provide Nickel Teflon coated sprinkler heads where corrosion resistant heads are required and as noted on plans)
2. Fusible Link: Glass bulb type temperature rated for specific area hazard. Contractor shall verify proper temperature selection in accordance with NFPA13 and coordination with any heat producing equipment located in close proximity to the sprinkler head.
3. Galvanized steel dry barrel with stainless steel inner tube
4. Design Basis: Victaulic Model V36 series (Quick Response).

H. Dry Standard Pendant, with guard (Exposed Sprinkler Areas) - Quick Response

1. Finish: Brass. (Provide Nickel Teflon coated sprinkler heads where corrosion resistant heads are required and as noted on plans)
2. Fusible Link: Glass bulb type temperature rated for specific area hazard. Contractor shall verify proper temperature selection in accordance with NFPA13 and coordination with any heat producing equipment located in close proximity to the sprinkler head.
3. Galvanized steel dry barrel with stainless steel inner tube
4. Design Basis: Victaulic Model V36 series (Quick Response).

I. Sidewall Type: Quick Response, Semi-recessed horizontal sidewall type with matching push on escutcheon plate.

1. Finish: Enamel, color as selected.
2. Escutcheon Plate Finish: Enamel, color as selected by Architect. Verify color selection in field with Architect prior to order and Installation.
3. Fusible Link: Glass bulb type temperature rated for specific area hazard. Contractor shall verify proper temperature selection in accordance with NFPA13 and coordination with any heat producing equipment located in close proximity to the sprinkler head.
4. Design Basis: Victaulic Model V27 series (Quick Response).

J. Dry Pendant Sprinklers (Within walk in coolers/Freezers): Quick Response, Dry pendant type with matching escutcheon plate.

1. Finish: Chrome plated.
2. Escutcheon Plate Finish: Chrome plated factory assembled.
3. Fusible Link: Glass bulb type temperature rated for specific area hazard.
4. Design Basis: Victaulic Model V36 series (Quick Response) with Integral AB6 assembly.

K. Guards: Finish chrome.

L. Flexible sprinkler connections: In lieu of rigid pipe offsets or return bends for sprinkler drops, the Victaulic VicFlex™ Multiple-Use Flexible Stainless Steel Sprinkler Drop System [with captured coupling Style 108] may be used to locate sprinklers as required by final finished ceiling tiles and walls. The drop system shall consist of a braided type 304 stainless steel flexible tube, zinc plated steel Male threaded nipple or Victaulic FireLock IGS Groove Style 108 coupling for connection to branch-line piping, and a zinc plated steel reducer with a female thread for connection to the sprinkler head.

1. Captured Coupling IGS Groove Style 108: Single-bolt, consisting of two ductile iron housings, Grade E “EPDM” gasket, and a zinc electroplated steel bolt and nut conforming to ASTM A449.
2. The drop shall include a UL-2443 approved and FM-1637 listed series AH2 braided hose with bend radius to 2” to allow for proper installation in confined spaces. The hose shall be listed for (5) bends at 36” length, (7) bends at 48” length, (9) bends at 60” length and be listed for (5) bends at 36” length, (7) bends at 48” length, (9) bends at 60” length and (10) bends at 72” length.
3. Union joints shall be provided for ease of installation. The flexible drop shall attach to the ceiling grid using a one-piece open gate Series AB1 bracket. The bracket shall allow installation before the ceiling tile is in place. The braided drop system is UL listed for sprinkler services to 175 psi. and FM Approved to 200 psi.
4. All hoses shall be factory-pressure tested to 400 psi.
5. AB6 Bracket Assembly, for use in cold storage applications with Victaulic Model V36 dry sprinklers.

6. Approvals:
   a. FM-1637
   b. UL 2443
7. Refer to the Victaulic I-VICFLEX installation manual and the Victaulic VicFlex™ Design Guide, as shown in product submittal 10.85 to ensure proper installation.

2.4 FIRE PROTECTION SERVICE ENTRANCE BACKFLOW PREVENTER

A. Acceptable Manufacturers

1. All backflow prevention devices shall be provided by from a single manufacturer.
2. Ames Co..
3. Watts.

B. Double Check Detector Assembly type (DCDA), U.L. Listed/FM approved, resilient wedge OS&Y gate valves, 300 series SS body and all internal parts, lead-free waterway construction, two independently operated tri-link check modules with reversible elastomer discs, single sleeve 304SS Sch.40 housing with grooved fittings, "low flow" bypass meter assembly and double chack assembly backflow preventer (contractor shall coordinate and install meter assembly requirements with Local Water Authority. Rated working pressure 175psi. Standards/Approvals ASSE1048, AWWA C551-92, CSA B64.5, Foundation for Cross-Connection Control and Hydraulic Research at The Unversity of Southern California (FCCCHR-USC) Contractor shall submit backflow preventer information to Water Authority for approval and coordinate all requirements with Water Authority in field prior to order.

1. Design Basis: Watts Model 757DCDA-OSY.

2.5 WET PIPE SPRINKLER ALARM CHECK VALVE

A. Acceptable Manufacturers

1. *All Alarm Valve, Riser Check Valves, and Floor Zone Control Manifold Assemblies shall be provided by from a single manufacturer.
2. Viking Corporation.
3. Victaulic.
4. Tyco.

B. Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm and electric alarm, with variable pressure trim w/pressure retard chamber, and test and drain valve. Valve internal parts shall be replaceable without removing the valve from the installed position.

1. Design Basis: Victaulic FireLock® Series 751 w/Series 752 pressure retard chamber, and Style 720 TestMaster™ test and drain valve.

2.6 WET PIPE SPRINKLER RISER-CHECK VALVE

A. Acceptable Manufacturers

1. *All Alarm Valve, Riser Check Valves, and Floor Zone Control Manifold Assemblies
2. shall be provided by from a single manufacturer.
   a. Viking Corporation.
   b. Victaulic.
   c. Tyco.

B. Check type valve with a spring-assisted, single disc design which provides a leak-free seal with as little as 5 ft/1.5 m of head. The valve shall feature a single disc mechanism incorporating a spring-assisted feature for non-slamming operation, as well as upstream and downstream pressure taps. Each valve to be factory tested to the rated working pressure.

1. Design Basis: Victaulic FireLock® Series 717R and 717HR.

2.7 FLOOR ZONE CONTROL MANIFOLD ASSEMBLY

A. Acceptable Manufacturers

1. *All Alarm Valve, Riser Check Valves, and Floor Zone Control Manifold Assemblies shall be provided by from a single manufacturer.
2. Viking Corporation.
3. Victaulic.
4. Tyco.

B. Grooved end cast iron manifold for horizontal or vertical installation, including butterfly valve with supervisory switch, check valve, flow switch, pressure gauge, and test and drain valve.

1. Design Basis: Victaulic FireLock® UMC Series

2.8 FLUSH MOUNT SPRINKLER SYSTEM FIRE DEPARTMENT CONNECTION

A. Acceptable Manufacturers

1. Potter Roemer.
2. Croker.
3. Guardian Fire Equipment

B. Type: Siamese Flush Wall Mount type.

1. Outlets: Chrome plated, flush wall mount, siamese connections with style/threads as required by local fire department. Verify all requirements with local Fire Marshal Prior to Order/Installation Provide threaded dust cap and chain of matching material and finish.
2. Drain: 3/4 inch automatic drip. Refer to FP detail drawings for additional installation details.
3. Inlet: 4"NPT Back/Top/Bottom (as required by piping arrangement
4. Wall Plate/Label: Polished Brass or polished chrome plated brass verify with Architect Prior to order.
   a. Lettering: "AUTO. SPKR.. STANDPIPE". Verify all signage requirements with local Fire Marshal Prior to submittal and Order/Installation.
5. Design Basis: Potter Roemer: Model 5021-D/5022-D/5023-D

C. Type: 5" Storz x 4"NPT Flush mounted wall type.

1. Outlets: Connections with style/threads as required by local fire department. Verify all requirements with local Fire Marshal Prior to Order/Installation Provide threaded dust cap and chain of matching material and finish.
2. Wall Plate/Label: Polished Brass or polished chrome plated brass/"AUTO. SPKR.. STANDPIPE". Verify all signage requirements with local Fire Marshal Prior to submittal and Order/Installation.
3. Design Basis: Potter Roemer: Model 5795-03 w/5962-B wall plate

2.9 FREE STANDING SPRINKLER SYSTEM FIRE DEPARTMENT CONNECTION

A. Acceptable Manufacturers

1. Potter Roemer.
2. Croker.
3. Guardian Fire Equipment

B. Type: Free standing, storz connection, ductile iron pedestal

1. Body: 29 in. high, 90 degree body with stainless steel internal screen, Hard coat, annodized aluminum standard finish. Includes 5-inch Storz x 4" FNPSH connection adapter, cap, sleeve, and labelled escutcheon plate. Coordinate escutcheon labelling with Local Fire Marshal prior to order.
   a. Basis of Design: Potter Roemer Model 5795-02-FS
      1) Provide optional 120 deg. adapter, 30 deg downturn (-120)
      2) Provide optional chrome finish adapter, cap, sleeve, and plate (-C)
      3) Coordinate Escutcheon lettering with Local Fire Marshal (-A) "AUTO SPKR" - Sprinkler Systems, (-S) "STANDPIPE" - Standpipe Systems, (-AS/SP) "AUTO SPKR STANDPIPE" - Combination Sprinkler and Standpipe systems, (-DS) "DRY STANDPIPE" - Dry Standpipe systems
2. Provide locking Knox Cap. Verify requirements with local Fire Marshal prior to order.
3. Drain: 3/4 inch automatic ball drip.
   a. Locate Ball drip in vault or at low point within building as noted on plans, pipe to floor drain or crushed stone base
4. Signage: Min. 10 inch x 14 inch, laminated aluminum ID plate. Verify signage requirements with local Fire Marshal prior to order. Verify signage mounting location with Architect and Local Fire Marshal in field prior to installation.
   a. "FDC - AUTO SPKR" - Sprinkler Systems
   b. "FDC - STANDPIPE" - Standpipe systems
   c. "FDC - AUTO SPKR STANDPIPE" - Combination Sprinkler and Standpipe systems
   d. "FDC - DRY STANDPIPE" - Dry Standpipe systems

C. Type: Free standing siamese connection, ductile iron pedestal with red glossy.

1. Body: 29 in. high, 45 degree body with clapper. 2-1/2"female x 2-1/2" female – NST connection inlets. Coordinate all connection type, size, and threads requirements and accessories with the local Fire Marshal prior to order; threaded dust cap and chain of matching material and finish.
   a. Basis of Design: Potter Roemer Model 5761
      1) Provide Optional Brass body with polished brass finish (-B)
      2) Provide Optional Brass body with rough chrome plaed finish (-C)
      3) Provide Optional Brass body with polished chrome plaed finish (-D)
      4) Coordinate Escutcheon lettering with Local Fire Marshal (-A) "AUTO SPKR" - Sprinkler Systems, (-S) "STANDPIPE" - Standpipe Systems, (-AS/SP) "AUTO SPKR STANDPIPE" - Combination Sprinkler and Standpipe systems, (-DS) "DRY STANDPIPE" - Dry Standpipe systems
2. Drain: 3/4 inch automatic ball drip.
   a. Locate Ball drip in vault or at low point within building as noted on plans, pipe to floor drain or crushed stone base

3. Signage: Min. 10 inch x 14 inch, laminated aluminum ID plate. Verify signage requirements with local Fire Marshal prior to order. Verify signage mounting location with Architect and Local Fire Marshal in field prior to installation.
   a. "FDC - AUTO SPKR" - Sprinkler Systems
   b. "FDC - STANDPIPE" - Standpipe systems
   c. "FDC - AUTO SPKR STANDPIPE" - Combination Sprinkler and Standpipe systems
   d. "FDC - DRY STANDPIPE" - Dry Standpipe systems

2.10 FLUSH MOUNT BACKFLOW PREVENTER TEST CONNECTION

A. Acceptable Manufacturers

1. Potter Roemer.
2. Croker.
3. Guardian Fire Equipment

B. Type: Flush Wall Mount type.

1. Outlets: Connections 2-1/2" NST threads, 2-1/2" hose valves with caps and chains
2. Finish: Chrome Plated
3. Drain: 3/4 inch automatic drip.
4. Inlet: 4"NPT Back/Top/Bottom (as required by piping arrangement
5. Wall Plate/Label: Polished chrome plated brass (verify with Architect Prior to order)
   a. Lettering: "TEST CONNECTION". Verify all signage requirements with local Fire Marshal Prior to submittal and Order/Installation.
6. Design Basis: Potter Roemer: Model 5862-D(two valve)/5863-D(Three valve)/5864-D(Four Valve)

2.11 STANDPIPE HOSE CONNECTION VALVES

A. Acceptable Manufacturers

1. Potter Roemer.
2. Croker.
3. Guardian Fire Equipment

B. Angle type; brass finish; 2-1/2 inch (65 mm) size, N.S.T. thread to match fire department hardware, 300 psi (2070 kPa) working pressure, with threaded cap and chain of same material and finish. Provide additional 2½"x1½" N.S.T. thread reducer with cap and chain of same material and finish.

1. Basis of Design: Potter Roemer: Model 4065

C. Locking Knox cap: Stainless steel construction with brass threads, 700psi rated pressure, Knox FDC wrench operated lock, Threads matching hose valve outlet threads

1. Basis of Design: Knox Model 40xx (xx-size and thread configuration to match Hose Valve)

D. Verify all requirements with local fire marshal and AHJ prior to order/installation.

2.12 STANDPIPE HOSE CONNECTION VALVE CABINET:

A. Acceptable Manufacturers

1. Potter Roemer.
2. Croker.

3. Guardian Fire Equipment

B. Recessed mounted, 20 ga. thick, 10" deep steel box prepared for pipe and accessory rough-in., 20ga. 304SS , flush, full metal hinged door w/positive latch device and Polished Stainless Steel finish.

1. Design Basis: Potter Roemer: Model FRC1810-F (w/10"deep box)

2.13 CLASS II STANDPIPE HOSE CABINET

A. Acceptable Manufacturers

1. Potter Roemer.
2. Croker.
3. Guardian Fire Equipment

B. 20 gauge box, 20 ga tubular steel door with 18 gauage fram and a continuous steel hinge, steel corner seams weleded and ground smooth. 1 1/2" super flex hose with brass fog nozzle

1. Cabinet and Door Design Basis: Potter Roemer: Model 1258-A
2. Rack and Valve Design Basis: Potter Roemer: 2510-10-24-31-43
3. Fire Department Valve Design Basis: Potter Roemer: 2 1/2" valve

C. Verify all requirements with local fire marshal and AHJ prior to order/installation.

2.14 ELECTRIC HORN/STROBE

A. Acceptable Manufacturers

1. *All electric notification devices shall be provided by from a single manufacturer.
2. SimplexGrinnell.
3. Wheelock.

B. U.L. listed, Weatherproof A/V horn/strobe, red cover with white lettering, regulated 24 DC, with weatherproof mounting box.

1. Design Basis: SimplexGrinnell True Alert Model 4906-9131 w/Model 4905-9828 weatherproof box.

C. Coordinate exact location and mounting with Local AHJ and coordinate required wiring to fire alarm panel with E.C. in field.

2.15 WATER FLOW SWITCH

A. Acceptable Manufacturers

1. *All flow, pressure and supervisory switches shall be provided by from a single manufacturer.
2. Potter Roemer.
3. System Sensor.

B. Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.

2.16 PRESSURE SWITCH

A. Acceptable Manufacturers

1. *All flow, pressure and supervisory switches shall be provided by from a single manufacturer.
2. Potter Roemer.

3. System Sensor.

B. Pressure switch for mounting in upright position, with two contacts; rated 15 amp at 125 volt AC and 2.5 amp at 30 volt DC.

2.17 SUPERVISORY SWITCH

A. Acceptable Manufacturers

1. *All flow, pressure and supervisory switches shall be provided by from a single manufacturer.
2. Potter Roemer.
3. System Sensor.

B. OSY type supervisory switch, with two contacts; rated 15 amp at 125 volt AC and 2.5 amp at 30 volt DC.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Design and provide fire suppression system in accordance with all referenced standards and local codes.

B. Install equipment in accordance with manufacturer's instructions.

C. Provide fire hose connection stations including hose connection valve and valve cabinets as indicated on plans with sufficient clearance from walls, obstructions, or adjacent structure to allow unobstructed access to hose connection. Verify exact locations, height above floor, door swing, threads, signage, and required accessories with the Local AHJ prior to order/installation.

D. Provide Fire Department Connections (FDC) at locations indicated on plans. Verify all Fire Department Connection details including style, connection type, height above grade, size, threads, and signage with local Fire Marshal or Fire Department prior to order/installation.

E. Locate outside horn strobe alarm on building wall above all fire department connections, outside room containing the fire protection service entrance valving, and as indicated on plans.

F. Place pipe runs to minimize obstruction to other work.

G. Provide penetration firestopping for all work of Div. 21 in accordance with Div. 07 specifications.

H. Field coordinate all exposed piping in finished spaces with Architect prior to fabrication or installation of piping. This field coordination of proposed pipe routing shall include on site review of submittal drawings with Architect and any other trades affected by the work.

I. In areas with finished ceilings, place piping in concealed spaces above finished ceilings. Coordinate piping locations between all trades prior to installation and final design. In exposed structure areas, all pipe routing shall be reviewed in field with Architect for final approval prior to installation of any work.

J. Center sprinklers within ACT ceilings in two directions relative to scoring and grid patterns as noted on approved architectural reflected ceiling plans. Refer to Fire Protection Details on contract drawings for additional information on centering of sprinklers within various ceiling types and patterns.

K. Align sprinklers symmetrically with other ceiling fixtures and elements as shown on approved architectural reflected ceiling plans.

L. Apply protective covers to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Covers shall be orange plastic with appropriate fastener for associated sprinkler type. Remove after painting. All painted sprinklers shall be replaced at no additional cost to the Owner. Coordinate work with G.C. prior to beginning any painting.

M. Flush entire piping system of foreign matter.

N. Install guards on all exposed sprinklers except where noted otherwise.

O. Provide sprinkler floor control valves at locations indicated on plans. Provide butterfly shutoff valve with tamper/supervisory switch, and check valve on inlet to floor control valves. Refer to details. Provide drain riser and pipe test and drains to drain riser. Terminate drain riser to building exterior at an approved location or as otherwise indicated on plans.

P. Provide system tests at locations as required by NFPA-13. Pipe all system test drains to building exterior in location approved by Architect , Owner , and AHJ.

Q. Hydrostatically test entire system in accordance with NFPA-13.Coordinate testing to be witnessed by Fire Marshal and authority having jurisdiction.

R. Provide system training for Owner representatives to include required maintenance, system supervisory devices, operating equipment, etc.

S. Provide identification for sprinkler system components and piping in accordance with Section 210553. Provide riser tags including hydraulic calculation information at all riser alarm valves and floor control assemblies

T. Provide laminated color coded Zone Maps to be displayed at main building fire alarm panel. Coordinate all requirements with local Fire Marshal prior to installation.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Ensure required devices are installed and connected as required to fire alarm system. Coordinate work between all trades.

3.3 SCHEDULES

A. System Hazard Areas:

1. Lobby/Vestibules, Classrooms, Offices, Corridors, Library (Seating/General use areas), Game Rooms, Auditoriums, Platforms, Meeting/Conference Rooms, Toilet rooms, and similar spaces: Light Hazard.
2. Science Labs, Science Lab Prep Rooms, Mechanical Room, Storage Spaces, Janitors Closets, Commercial Kitchens, Mail Rooms, and similar spaces: Ordinary Hazard, Group 1.
3. Stages, Library (Stack areas) and similar spaces: Ordinary Hazard, Group 2.

END OF SECTION 21.1300

SECTION 22.0100 - GENERAL PROVISIONS

PART 1 - GENERAL

1.1 FIRE UNDERWRITER SEAL:

A. Where applicable, all material shall bear the National Board of Fire Underwriters' Seal of Approval. Certificates to this effect to be furnished to Architect upon request.

1.2 DEFINITION OF WORK RESPONSIBILITY:

A. Unless noted otherwise by the multiple contract summary, all work shall be performed as noted below.

B. All electrical control components including starters required for operation of Plumbing equipment whether integral or remote shall be furnished and installed under this Contract. Control wiring, conduits and accessories for control devices shall be furnished and installed by the Contractor who provides the equipment. See Division 26 specifications for starters, combination starters, and switches.

C. Power wiring from panel boards or similar source through all equipment disconnects to motors or plumbing equipment shall be furnished and installed by the Electrical Contractor.

D. Equipment disconnect switches, unless otherwise specified or supplied by the equipment supplier as an integral part of the equipment shall be furnished and installed by the Electrical Contractor.

E. All electrical equipment, components, and wiring furnished and installed under this portion of the specifications shall conform to all requirements of the applicable portions of the Division 26 electrical specifications.

F. All base flashing, where required, shall be by the General Contractor, with necessary counter-flashing by this contractor. Flashing shall comply with the requirements of Division 07.

G. All structural work needed for support of plumbing equipment, piping, specialties, or components shall be provided by this contractor unless shown on structural plans.

1.3 RULES AND REGULATIONS:

A. Contractor shall be licensed by the Municipality/Township in which the work is performed. Contractor is responsible for meeting all licensing requirements of the Municipality and securing all necessary certifications prior to beginning work. Copies of these licenses must be posted within the respective job trailers during construction.

B. All work shall be performed in accordance with the rules and regulations of the ICC Codes, local plumbing codes, the utilities having jurisdiction, and the NFPA Codes.

C. All work shall be performed in accordance with the rules and regulations or Pennsylvania Department of Labor and Industry, Federal Department of Labor (Occupational Safety and Health Administration), the Department of Education (where applicable), and all codes and agencies having jurisdiction.

D. All construction, design fabrication, tests, rating and installation shall comply with the rules and regulations of all local, state or national codes and agencies having jurisdiction over this project. Any costs involved in complying to these rules and regulations shall be included in original bid of this Contractor.

E. Refer to Div.01 specifications for Permit application and cost responsibilities for work of this Contract.

1.4 ANCHOR BOLTS:

A. This Contractor shall provide and set in place at the time the foundations, bases, or curbs are poured, all necessary anchor bolts as required for the various equipment specified herein, to be furnished under Div. 22 specifications. Anchor bolts must be of the hook type and of the proper sizes and length to suit the apparatus. The bolts shall be set in pipe sleeves of approximately twice the bolt diameter and as long as the imbedded length of the bolt.

B. When the equipment is set in its proper position, the bolt sleeves and the space between the rough foundations, bases or curbs of the equipment shall be completely filled with one inch of non-shrinking cement grout.

C. This contractor shall assume all responsibility for the location of all anchor bolts for the equipment furnished under Div. 22 specifications, and must have a man present at the time the foundation, bases, or curbs are poured.

1.5 DRAWINGS:

A. The accompanying drawings are a part of these specifications and are intended to show approximate and relative locations of services and equipment. They shall not be scaled to determine exact positions, locations and clearances.

B. Due to the diagrammatic layout and small scale of the drawings, certain piping and duct rises, drops, offsets, valves, and related specialties are not shown. The Contractor shall provide all piping, fittings, valves, and specialties required to insure a complete installation without additional cost to the Owner.

C. All drawings and specifications pertaining to General Construction, Plumbing, HVAC, Electrical and other work shall be carefully examined. All work shall be coordinated prior to installation. Where physical interferences with installed work occur because of failure of this Contractor to coordinate with other trades, this Contractor shall remove and reinstall the work at his own expense.

1.6 SUBMISSION OF SHOP DRAWINGS, EQUIPMENT AND MATERIALS

A. Refer to Division 1 for additional submittal requirements.

B. Contractors shall include with each submittal / shop drawing, a matrix outlining all items that do not match the specified items. If an item is not listed on the matrix, the submitted unit will be assumed to meet all parts of the specification. Contractors will be responsible to ensure that the specifications are met in full. Items in matrix shall include scheduled performance data vs. submitted performance data, specified components vs. submitted unit components, specified construction weight, warranty, etc. vs. submitted construction, weight, warranty, etc.

C. All material submittals shall be submitted in individual submittal packages corresponding to the specification Section and Paragraph of the "Part 2 - Products" section within the applicable Div. 22 specifications for the submitted material. Submittal packages with multiple types of materials from multiple spec sections and combined into a bulk submittal package delays review time and may be rejected without review.

1.7 VISIT TO THE SITE:

A. Prior to submission of his bid, the Contractor shall visit the site to acquaint himself with the existing conditions. Bids as submitted will be interpreted to include all costs and change made necessary by such conditions.

1.8 COORDINATION OF WORK:

A. Contractor shall coordinate his work with that of other trades. In case of interference or problems the Architect shall decide which work is to be relocated, regardless of which is installed first.

B. The Contractor shall prepare coordination/arrangement CAD drawings for coordination with all other trades. The contractor shall furnish these coordination drawings to the contractor responsible for project BIM coordination.

C. This Contractor shall obtain approval of all arrangement drawings before continuing with installation of his work.

1.9 LOCATION OF EQUIPMENT:

A. All locations of plumbing, HVAC and fire protection equipment and pipe connections there to shall be verified by the Owner and Architect. The contractor shall verify locations sufficiently in advance of the installation to allow uninterrupted progress of the work of all trades.

1.10 MATERIALS AND EQUIPMENT:

A. All materials and equipment, unless otherwise specified, shall be new and of the best quality, approved for their specific application.

B. This Contractor shall provide, when required by the Architect, labeled samples of materials to be used on the project. Samples shall be submitted for approval by the Architect prior to their installation.

C. All materials and equipment installed by the Contractor shall be securely and rigidly supported from or attached to the building structure.

1.11 WORKMANSHIP:

A. All workmanship shall be done according to the best practices of the trade by qualified and competent tradesmen.

1.12 PROTECTION OF EQUIPMENT:

A. The Contractor shall protect all material and equipment from damage until final acceptance as installed. He shall close all openings during construction with temporary plugs and replace all damaged items with ones of exact sameness at his expense.

B. He shall schedule material and systems for deliver in such a pattern that critical pieces of equipment may be stored within the building, protected from weather. Where materials are stored outside, they must be protected from the elements and damage.

C. This Contractor shall be responsible for coordinating the procurement of specified materials and equipment being supplied by his sub-contractors and suppliers.

1.13 SCAFFOLDING AND HOISTING:

A. The Contractor shall furnish and erect all scaffolding, hoists, shoring, platforms, railings, ladders, and other devices required by local, state, and federal laws to install his systems and equipment. Scaffolding and all other equipment shall be removed at completion of the work.

B. Contractor shall hoist or rig his own material and equipment into place, or arrange for the rigging of it by others at his expense.

1.14 FOREMAN:

A. Contractor must provide a competent foreman, subject to approval of the Owner. The foreman shall be deemed the agent of the Contractor and must be on duty at the building during all working hours.

B. Any instructions or notices given to the foreman shall be considered equivalent to the instruction or notices being given to the Contractor in person.

1.15 SLEEVES:

A. Each Contractor shall furnish and set all sleeves required for the installation of his work and shall be responsible for their final and permanent locations.

B. All pipes passing through masonry construction shall be fitted with sleeves. Each sleeve shall extend through its respective floor or wall and shall finish flush with each surface unless otherwise required. Unless otherwise specified or shown, sleeves shall be two pipe size larger than the overall outside diameter of the pipe when insulated. Sleeves in bearing and masonry walls shall be made of standard weight galvanized steel pipe. Sleeves through concrete floor slabs and other partitions shall be 18 ga. galvanized steel.

C. Where sleeves pass through foundation walls, the space between such sleeves and passing pipes shall be caulked with graphite packing and an approved plastic and waterproof caulking compound as approved by the Architect. In lieu of caulking materials, Contractor has option of using preassembled "Link-Seals" as manufactured by Thunderline Corporation, 5495 Treadwell, Wayne, Michigan 48184.

D. All sleeves shall be properly installed and securely fastened in place. Where pipes pass through waterproofed floor or walls, design of sleeves shall be such that the waterproofing can be properly flashed around the sleeves, and of such height that the water will be prevented from entering sleeves and dripping to any finished areas below.

E. Contractor shall seal all piping penetrations through all walls and floors. Where pipes pass through fire resisting portions of the structure, the annular space between the sleeve and the pipe shall be filled with an approved fireproof material. Refer to Division 1 specifications for fireproofing requirements.

1.16 CONCRETE AND MASONRY WORK:

A. The General Contractor shall furnish and install all concrete bases, reinforcing, etc. required to install the Mechanical Work, unless otherwise noted.

B. The Contractor, prior to installing any forms, reinforcing or concrete, shall notify all other Contractors or subcontractors, in ample time for them to install any portion of their work which is to be concealed in the concrete. No such work shall be placed in a manner to interfere with the proper placing of the reinforcement unless so authorized by the Architect.

1.17 ESCUTCHEONS:

A. All exposed pipes, except as otherwise described, passing through walls, floors, ceilings, etc. in finished spaces, shall be provided with solid pattern heavy ceiling, floor or wall escutcheons with set screw. Escutcheons and plates shall be of steel or malleable iron with prime coat ready for painting. Escutcheons will not be provided where sleeves intentionally extend above finished floor.

B. All exposed plumbing short branch connections to fixtures and/or equipment passing through wall or floors shall be equipped with pressed brass, chromium plated, solid-type escutcheons.

C. Provide angle collars at ducts where they pass through finished walls, floors and ceilings.

1.18 ACCESS DOORS AND PANELS:

A. All ceiling access panels not shown on the Architectural Reflected Ceiling plans and all additional wall or ceiling access panels required for access for the work of this section shall be furnished by this Contractor and set by the General Contractor. The location of these access panels must be approved by the Architect prior to their installation. The Contractor shall furnish an access panels where valves, specialties, junction boxes, and other serviceable items are installed behind plaster, tile, or similar type non-removable surfaces.

B. Refer to Section 08 3113 - "Access Doors and Frames" for specific requirements.

1.19 CUTTING AND PATCHING:

A. In areas of new construction, this Contractor shall give the General Contractor complete information as to size of openings to be provided by the General Contractor in new floors, and walls, etc., so that such openings may be provided as the project progresses.

1. If openings are omitted or are incorrect through failure of this Contractor to coordinate the required openings, this Contractor shall, at his own expense, engage the trade which originally installed the work, to cut and patch to the satisfaction of the Architect.

B. Unless noted otherwise in the Div. 01 specifications, this Contractor shall be responsible for the cutting of existing floor slabs for the installation/demolition of any underground piping systems required by the plumbing drawings and Div. 22 specifications. This Contractor is responsible for proper bedding, backfill materials and compaction (as outlined in the specifications and on the drawings) to an elevation that is level with the bottom of the existing concrete floor slab. Patching of floor slabs shall include dowels into existing slab, wire mesh reinforcing, and all additional requirements as detailed on the Architectural and Structural drawings.

C. Unless noted otherwise in the Div. 01 specifications, this Contractor shall be responsible for the cutting and patching of exposed surfaces as required for the installation/demolition of any work of the plumbing drawings and Div. 22 specifications. All holes cut shall be in a manner approved by the Architect. Patching of existing construction and finishes must be equivalent to adjacent finishes and materials.

D. Where it becomes necessary to cut out any portions of walls, floors, ceilings, roof or other portions of the building for the installation of work, and as may be required to perform and complete the work under this Contract, the Contractor shall do all necessary cutting and fitting, shall remove all excess material, and shall replace all work damaged so as to leave the entire premises in a finished condition.

E. No cutting shall be done which may in any way affect the building structurally or architecturally. Any damage incident to cutting or other causes in the performance of this Contract shall be corrected by replacement or repairs. Cutting shall be done only with the prior approval of the Architect.

F. Contractor shall seal all piping penetrations through all walls and floors. Penetrations through fire rated walls or floors shall be sealed with an approved UL Listed fire sealant.

1.20 GUARANTEE:

A. Refer to Div.01 specifications for Warranty requirements. Where warranty requirements are not specified in Div.01, this Contractor shall unconditionally guarantee in writing all materials, equipment, and workmanship for a period of one years from date of acceptance by Owner. The Contractor shall provide free service for all equipment involved in his Contract during this guarantee period.

B. The guarantee shall include restoration to its original condition of all adjacent work that must be disturbed in fulfilling this guarantee.

C. All such repairs and/or replacements shall be made without delay and at the convenience of the Owner.

1.21 CLEANING OF SYSTEMS:

A. The Contractor shall thoroughly clean all pipe systems to remove all grease, oil scale, core, sand and other foreign material after tests have been made and before the building is turned over to the Owner.

B. All strainers shall be opened and cleaned thoroughly.

C. Should the Contractor put any substance into any system to aid in the cleaning of it, all trace of such material shall be removed before the system is considered clean. All such substances, if used, shall be free from any acid that will set or injure valve seats, or other piping specialties in any way.

1.22 INSTRUCTION TO EMPLOYEES:

A. At the completion of the work, and before final acceptance of the building by the Owner, each Contractor, together with the representatives of the manufacturers of the equipment installed by the Contractor, shall instruct the designated employees of the Owner in the care, adjustment, maintenance and operation of equipment installed by him.

B. Three copies of factory maintenance schedules shall be furnished for each piece of equipment. Acceptance of materials and equipment is conditional upon receipts of maintenance manuals.

C. A representative of the manufacturer of each piece of equipment shall inspect his respective pieces of equipment, make final adjustments, and put them in a satisfactory working condition.

1.23 SUBSTITUTIONS:

A. Substitutions, if permitted, must comply with the requirements of the Instruction to Bidders for pre-bid substitutions and with Division 01 Section "Product Requirements" for post-bid substitutions.

B. Various items of equipment and materials that have been used as the basis for plumbing system design have been specified by a manufacturer's name and model number. Another manufacturer's product may be submitted for consideration as a substitute in accordance with Div. 01 requirements. The Architect/Engineer shall be the sole judge as to the comparability of an item of equipment that is submitted for approval as a substitute for that which is specified. Each substitute proposals shall include all labor and materials that will be required to install the equipment and make it operate satisfactorily in accordance with the original design concept. Changes required in piping, valves, supports, fittings, ductwork, motors, controls, electrical wiring, and thermal insulation, etc. shall be included. It shall be the responsibility of the Contractor to make certain that substitute equipment, which has been accepted by the Architect will fit into the designated spaces. Contractor shall make the necessary field measurements in order to determine that there is adequate space for the equipment, taking into consideration the clearances that are required for connections and servicing.

C. If any changes are required in the installation of mechanical or electrical services to any plumbing equipment accepted as a substitution to the basis of design, the Plumbing Contractor shall be responsible for any additional costs incurred to the Owner, Engineer, other contractors and costs incurred for changes to the coordination drawings

1.24 ALTERNATES:

A. Various items of equipment and materials that have been used as a basis for plumbing system design have been specified by a manufacturer's name and model number. Where another manufacturer's product has been specified as an alternate to this equipment the proposed cost for this alternate shall include all labor and materials that will be required to install the equipment and make it operate satisfactorily in accordance with the original design concept. He shall include such things as changes in piping, valves, supports and supporting structure, fittings, ductwork, motors, controls, electrical wiring and thermal insulation. It shall be the responsibility of the contractor to make certain the alternate equipment will fit into the designated spaces. He shall make the necessary field measurements in order to determine that there is adequate space for the equipment, taking into consideration the clearances that are required for connections and servicing.

1.25 ALIGNMENT:

A. Where several receptacles, devices, bells, alarms, thermostats, switches, handles, etc., are to be installed in a common location, this equipment shall be lined up in a vertical plane. It is the Contractor's responsibility to confer with the Architect on this alignment.

B. This Contractor shall carefully check all the Drawings and coordinate their work with all trades to provide for a symmetrical and coordinated ceiling. Ceiling T-bars, lights, registers, and other equipment shall all be symmetrically installed with provisions made for integrating the T-bars and this equipment. Failure to coordinate will result in relocation of ceiling components as directed by the Architect at the Contractor's expense.

1.26 OPERATION AND MAINTENANCE INSTRUCTIONS:

A. Refer to Division 01 "Close-out Procedures" as well as the following.

B. The Contractor shall prepare closeout documents in accordance with Div.01 specifications. Where not specified in Div.01 specifications, the Contractor shall prepare for the Owner, 3 hard bound volumes, each containing all operating instructions and information necessary for the care and maintenance of the system. These volumes shall be complete in every respect, and shall include detailed operating instructions for each piece of equipment and diagrams for control wiring and piping so arranged and detailed that the maintenance staff may trace the control in the event of operational malfunctioning.

C. The Contractor shall submit 1 of the hard-bound volumes (or electronic copy) to the Architect/Engineer for approval prior to submitting same to Owner.

D. The purpose of this manual is to assist the Owner in routine operation, maintenance, servicing, troubleshooting and procurement of replacement parts. All information in the manual shall be as-built and only material pertinent to the project shall be included.

E. The operating manual shall be considered a part of the final inspection and shall be submitted for approval at least 30 days in advance of a request for final inspection. The manual shall include:

1. A copy of all final corrected equipment submittals, control diagrams, descriptive brochures, and a list of all parts of each piece of mechanical and electrical equipment which has been furnished and installed.
2. Complete and detailed typewritten operating and maintenance instructions for all major operating equipment. The operating and start-up instructions shall be written in a concise, step by step manner. Maintenance instructions shall include such things as periodic checks, adjustments and troubleshooting techniques.

3. A listing of all items of mechanical and electrical equipment, a compilation of the nameplate data for this same equipment, the name, address and telephone number of the nearest service organization.
4. Copies of all A.S.M.E. pressure vessel certifications, state police approved tank permits, complete additional valve tag schedules, all electrical inspection permits and all additional mechanical and electrical permits required for occupancy by the Owner.
5. All of the materials shall be indexed, arranged categorically and be bound in a rigid, plastic covered, three ring binder.

F. The Contractor shall provide Project Record (As-Builts) documents in accordance with requirements of Div. 01 specifications.

G. O & M manuals must be provided prior to equipment being turned over to the Owner.

H. Warranty period shall begin starts when Owner begins occupancy the building or related phase/area of construction.

1.27 PAINTING:

A. Refer to Division 09 Section "Paintings and Coatings" for painting requirements as well as the following.

B. Provide corrosion inhibiting prime coating on all ferrous materials installed on exterior of building. Coordinate color with Archtect in field. Protect all adjacent building surfaces during painting.

C. Paint all metal laid underground trenches with corrosion protective materials.

D. All exposed piping, iron work, and equipment installed in the mechanical equipment rooms under this contract shall be painted 1 prime coat and 2 coats of best quality oil paint of color as selected by the Architect.

E. All exposed gas piping within boiler rooms and mechanical rooms shall be painted yellow and identified as required in Division 22 specifications.

F. Unless specifically noted, insulation and galvanized piping in ceiling cavity area shall not be painted.

G. Painting of piping within exposed finished areas within the building interior shall be by the General Contractor. Installation of piping by the contractor shall include cleaning and prep of the piping for final painting by General Contractor

1.28 EARTHWORK:

A. Refer to Division 31 as well as the following.

B. Provide all excavating, backfilling, shoring, sheeting, pumping, bailing, etc., required for the installation of the work of this Section.

C. Trench depths shall allow adequate cover over piping, walls shall be vertical and bottoms shall be instrument graded. Earth shall be scooped out under pipe hubs to provide a solid bearing for the barrel of the pipe on undisturbed earth. Concrete or other approved supports shall be provided for all pipes installed in fill.

D. Carry pipe trenches in rock below the pipe invert at least 1/4 the nominal diameter of the pipe or a minimum of 4" below the bottom of the pipe whichever is the greater. Backfill space below pipe with crushed stone or gravel ranging in size from 1/4" to 3/4".

E. Excavation under footings or foundations and deeper than the angle of repose from footings or foundations as determined by the Architect shall be backfilled solidly with 3,000-pound concrete, to such angle of repose and bottom of such footing or foundation. Where excavation damages existing lawns, sidewalks, roadways etc., such surfaces shall be restored to their original condition by the Contractor performing the excavation.

F. All excavated material remaining after the backfilling operation shall be removed from the site by this Contractor.

G. Any settlement in trench backfill shall be brought to grade, and damage to pavement or slabs caused by such settlement shall be repaired at the Contractor's expense.

H. All repair of macadam or concrete paving made necessary by work done under this contract shall be performed by General Contractor at the expense of this contractor. All such repairs shall match surrounding paving in materials and workmanship.

END OF SECTION 22.0100

SECTION 22.0502 - EXCAVATION, BACKFILL & COMPACTION FOR UTILITY TRENCHES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

B. Division 31 - Earthwork

1.2 SUMMARY

A. This Section includes the following:

1. Excavation, backfill and compaction associated with utility construction including such related features as protection of adjacent utilities and structures, maintenance and protection of traffic, cutting paved surfaces, support of excavation, control of excavated materials, dewatering, piping, bedding, disposal of excavated materials, and all work related to providing all utilities and structures in connection with sanitary sewer piping.

1.3 DEFINITIONS

A. Backfill: Stone materials or imported structural fill materials.

B. Bedding Course: Layer placed over the excavated subgrade in a trench before laying a pipe.

C. Utilities: Include on-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.4 SUBMITTALS

A. Refer to Division 01 Specifications for submittal procedures

B. Certificates: Submit certification attesting that the composition analysis of pipe embedment and select material stone backfill materials meet specification requirements.

1.5 QUALITY ASSURANCE

A. Codes and Standards: Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.

B. Testing and Inspection Service: Owner shall hire an independent testing and inspection agency to perform all soil testing during earthwork operations.

C. Testing Laboratory Qualifications: To qualify for acceptance, the testing laboratory must demonstrate to Architect's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM E 699, that it has the experience and capability to conduct required field and laboratory testing without delaying the progress of the work.

D. Testing & Inspection Agency: The Owner will provide and pay for the services of an Independent Testing & Inspection Agency who will have the responsibility of determining what subgrade is acceptable or unacceptable and must be removed by the Contractor. The imported fill or imported structural fill shall be installed and compacted under the direction and observation of the Independent Testing & Inspection Agency. The Independent Testing & Inspection Agency will also document quantities of all materials on a daily basis. The Independent Testing & Inspection Agency will also monitor other earthwork that the Owner determines.

1.6 PROJECT CONDITIONS

A. Excavation and Rock Removal:

1. General:
    a. The Contractor shall complete the excavation as indicated on the drawings and in Division 01.
    b. When excavation has reached required subgrade elevations, notify Architect or Independent Testing & Inspection Agency, who will make an inspection of conditions. If the Independent Testing & Inspection Agency determines that bearing materials at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are encountered and replace excavated material as to the extent directed by the Independent Testing & Inspection Agency.
2. Excavation Classifications: Refer to Division 01 and Division 31.

B. Compaction of Backfill:

1. Placing of Fill Materials: Place the specified structural fill, stone backfill and in all areas, in layers not more than 6” in loose depth for material compacted by heavy compaction equipment, and not more than 4” in loose depth for material compacted by hand-operated tampers.
2. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification.
3. Place imported structural fill, backfill and fill materials evenly adjacent to structures to required elevations. Prevent wedging action of backfill against structured by carrying material uniformly around structure to approximately same elevation in each lift.
4. Compaction: Provide fill compaction to minimum percentage of density specified for each area classification indicated below. Correct improperly compacted area or lifts as directed by Architect or Construction Manager if density tests indicated inadequate compaction.
    a. Percentage of Maximum Density Requirements: Compact to not less than the following percentages of maximum dry density, in accordance with ASTM D 698.
        1) Under concrete building slabs, under concrete foundations and footings, compact each layer of imported structural fill material at 98 percent of maximum dry density. Extend compacted area beyond the exterior face of the building a distance equal to the depth of fill at that area but not less than 10 feet.
        2) Under exterior concrete and asphalt paving compact each layer of backfill or fill material at 98 percent of maximum dry density.
        3) Under lawn or unpaved areas, compact each layer of backfill or fill material at 95 percent of maximum dry density.

4) At exterior face building foundation walls and walls beyond the exterior of the face of the building, each layer of backfill or fill shall be compacted to 95 percent of maximum dry density.
5) At asphalt and concrete paving the top 6 to 8 inches of subgrade under the paving and aggregate base course shall be compacted to 98 percent of the maximum dry density. The aggregate base course shall also be compacted to 100 percent of the maximum dry density.

C. Protection of Existing Utilities and Structures:

1. Take all precautions and utilize all facilities required to protect existing utilities and structures. In compliance with Act 199 (2004) of the General Assembly of Pennsylvania, advise each Utility at least three (3) working days in advance of intent to excavate, do demolition work and give the location of the job site. Request cooperative steps of the Utility and suggestions for procedures to avoid damage to its lines.
2. Advise each person in physical control of powered equipment used in excavation or demolition work of the type and location of utility lines at the job site, the Utility assistance to expect, and procedures to follow to prevent damage.
3. Immediately report to the Utility and the Architect any break, leak or other damage to the lines or protective coatings made or discovered during the work and immediately alert the occupants of premises of any emergency created or discovered.
4. Allow free access to Utility personnel at all times for purposes of maintenance, repair and inspection.

1.7 COLD WEATHER PROTECTION

A. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F

PART 2 PRODUCTS

2.1 PIPE BEDDING OR EMBEDMENT MATERIAL

A. Refer to details on drawings.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Layout utility trenchwork and establish extent of excavation by area and elevation. Designate and identify datum elevation and project engineering reference points. Set required lines, levels, and elevations.

B. Notify Architect of unexpected subsurface conditions and discontinue work in area until notified to resume work.

C. Maintain and protect existing utilities identified by utility users within the Work area.

D. Verify that structure walls are braced to support surcharge forces imposed by backfilling operations.

3.2 PROTECTION OF ADJACENT WORK

A. Underpin adjacent structures which may be damaged by excavation work, including utilities and pipe chases.

B. Grade excavation top perimeter to prevent surface water runoff into excavation or to adjacent properties.

3.3 EXCAVATION

A. Width of Excavation:

1. Pipelines:
   a. Excavate trenches, including laterals, to a width necessary for placement and jointing of the pipe, and for placing and compacting pipe embedment under, around and over the pipe.
   b. Shape trench walls completely vertical from trench bottom to at least two (2) feet above the top of the pipe.
   c. For pressure pipeline fittings, excavate trenches to a width that will permit placement of concrete thrust blocks. Provide earth surfaces for thrust blocks that are perpendicular to the direction of thrust and are free of loose or soft material.

B. Length of Open Trench:

1. Do not advance trenching operations more than 200 feet ahead of completed pipeline.

3.4 SUPPORT OF EXCAVATION

A. Support excavations with sheeting, shoring, and bracing or in the case of pipeline construction, a "trench box" as required to comply with State, and local laws and codes.

B. Install adequate excavation supports to prevent ground movement or settlement to adjacent structures, pipelines or utilities. Damage due to settlement because of failure to provide support or through negligence or fault of contractor in any other manner, shall be repaired at contractor's expense.

C. Withdraw shoring, bracing, and sheeting as backfilling proceeds unless otherwise directed by the Architect.

D. The neglect, failure or refusal of the Architect to order the use of bracing or sheeting, or a better quality, grade, or section, or larger sizes of steel or timber, or to order sheeting, bracing, struts, or shoring to be left in place, or the giving or failure to give orders or directions as to the manner or methods of placing or driving sheeting's, bracing, jacks, wales, stringers, etc., shall not in any way or to any extent relieve Contractor of any responsibility concerning the condition of excavation or of any of his obligations under the Contract, nor shall any delay, whether caused by any action or want of action on the part of Contractor, or by any act of Owner and Architect or their agents, or employees, resulting in the keeping of an excavation open longer than would otherwise have been necessary, relieve contractor from the necessity of properly and adequately protecting the excavation from caving or slipping, nor from any of their obligations under the Contract relating to injury of persons or property, nor entitle them to any claim for extra compensation.

3.5 DEWATERING

A. Keep excavations dry and free of water. Dispose of precipitation and subsurface water clear of the work.

B. Maintain pipe trenches dry until pipe has been jointed, inspected, and backfilled, and concrete work has been completed. Prevent trench water from entering pipelines under construction.

3.6 PIPE LAYING

A. Provide required pipe bedding placed in accordance with the Drawing Details and Specifications.

B. Shape recesses for the joints or bell of the pipe by hand. Assure that the pipe is supported on the lower quadrant for the entire length of the barrel.

C. Lay pipe as specified in the appropriate Section of these Specifications for pipeline construction.

3.7 BACKFILLING EXCAVATIONS

A. Pipeline Trench:

1. After pipe installation and inspection, provide material to complete the pipe embedment in accordance with the Drawing Details and Specifications.

B. Lift Thickness Limitations:

1. Lift thicknesses shall be limited to 4 inches for pipe embedment, and 6 inches maximum for pipeline trenches within paved areas and non-paved areas and for structure excavations. In no case shall maximum lift thickness placed exceed the maximum limits specified by the manufacturer's recommendations for the compaction equipment to be utilized. Compaction equipment shall not be used over the pipe until sufficient backfill has been placed to insure that such equipment will not damage or disturb the pipe.

C. Unsuitable Backfill Material:

1. Where the Independent Testing & Inspection Agency or Architect determines backfill material to be unsuitable and rejects all or part thereof due to conditions prevailing at the time of construction, remove the unsuitable material and replace with suitable backfill material. Unsuitable material shall be legally disposed of, off-site by the contractor.

3.8 FIELD QUALITY CONTROL

A. Quality Control testing During Construction: Contractor shall coordinate with Owner’s testing laboratory to inspect and approve each subgrade and fill layer before further backfill or construction work is performed.

1. Perform field density tests in accordance with ASTM D 1556 (sand cone method) or ASTM D 2167 (rubber balloon method) as applicable.
   a. Field density tests may also be performed by the nuclear method in accordance with ASTM D 1556. In conjunction with each density calibration check, check the calibration curves furnished with the moisture gages in accordance with ASTM D 3017.
   b. If field tests are performed using nuclear methods, make calibration checks of both density and moisture gages at beginning of work, on each different type of material density and moisture gages at beginning of work, on each different type of material encountered, and at intervals as directed by the Architect.
2. Perform one test at each structure per foot of backfill and one test for each 50 lineal feet of pipe or fractions thereof, per foot of backfill.

3. If in opinion of Architect, based on testing service reports and inspection, subgrade or fills that have been placed are below specified density, perform additional compaction and testing until specified density is obtained. trenching and backfilling operations with Independent Testing and Inspection Agency to perform field inspections and tests during trenchwork operations. Laboratory, inspection service, and Independent Testing & Inspection Agency shall be subject to acceptance by the Architect.

3.9 DISPOSAL OF EXCAVATED MATERIAL

A. No excavated material shall remain after completion of backfilling. Excavated material shall be removed from the construction area, and disposed of legally, off-site.

3.10 CLEANUP

A. Upon completion of trenchwork operations, clean areas within contract limits, remove tools and equipment. Provide site clear, clean, free of debris, and suitable for site work operations.

END OF SECTION 220502

SECTION 22.0516 - EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flexible pipe connectors.

B. Expansion joints and compensators.

C. Pipe loops, offsets, and swing joints.

1.2 RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping.

1.3 REFERENCE STANDARDS

A. ASTM A 269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2008.

B. EJMA (STDS) - EJMA Standards; Expansion Joint Manufacturers Association; 2003.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data:

1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

C. Design Data: Indicate selection calculations.

D. Manufacturer's Instructions: Indicate manufacturer's installation instructions, special procedures, and external controls.

E. Project Record Documents: Record installed locations of flexible pipe connectors, expansion joints, anchors, and guides.

F. Maintenance Data: Include adjustment instructions.

1.5 REGULATORY REQUIREMENTS

A. Conform to UL requirements.

1.6 EXTRA MATERIALS

A. See Section 01 6000 - Product Requirements, for additional provisions.

B. Supply two sets of packing for each packed expansion joint.

PART 2 PRODUCTS

2.1 THERMAL EXPANSION LOOPS - COPPER PIPING

A. Manufacturer:

1. Flexicraft Industries: www.flexicraft.com
2. Metraflex Company: www.metraflex.com.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Inner Hose: Bronze.

C. Exterior Sleeve: Braided bronze.

D. (2) two 90° elbows, and (1) 180° return w/drain/air release plug: Bronze

E. Pressure Rating: 125 psi and 450 degrees F.

F. Joint: Flanged.

G. Size: Use pipe sized units.

H. Offset: As calculated per application. Manufacturer to calculate and verify acceptable offset for corresponding lengths of piping served

I. Installed in neutral position

2.2 EXPANSION LOOPS - SEISMIC/BUILDING EXPANSION JOINTS - COPPER PIPING

A. Manufacturer:

1. Flexicraft Industries: www.flexicraft.com
2. Metraflex Company: www.metraflex.com.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Inner Hose: Bronze.

C. Exterior Sleeve: Braided bronze.

D. (2) two 90° elbows, and (1) 180° return w/drain/air release plug: Bronze

E. Pressure Rating: 125 psi and 450 degrees F.

F. Joint: Flanged.

G. Size: Use pipe sized units.

H. Installed in neutral position. Provide Seismic bracing as determined by seismic engineer

2.3 EXPANSION LOOPS - SEISMIC/BUILDING EXPANSION JOINTS - STEEL PIPING

A. Manufacturer:

1. Flexicraft Industries: www.flexicraft.com
2. Metraflex Company: www.metraflex.com.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Inner Hose: Stainless Steel.

C. Exterior Sleeve: Braided Stainless Steel.

D. (2) two 90° elbows, and (1) 180° return w/drain/air release plug: Stainless Steel

E. Pressure Rating: 125 psi and 450 degrees F.

F. Joint: Flanged.

G. Size: Use pipe sized units.

H. Installed in neutral position. Provide Seismic bracing as determined by seismic engineer

2.4 FLEXIBLE PIPE CONNECTORS - STEEL PIPING

A. Manufacturers:

1. Flexicraft Industries: www.flexicraft.com
2. Metraflex Company: www.metraflex.com.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Inner Hose: Stainless Steel.

C. Exterior Sleeve: Single braided, stainless steel.

D. Pressure Rating: 125 psi and 450 degrees F.

E. Joint: Threaded.

F. Size: Use pipe sized units.

G. Maximum offset: 1 inch on each side of installed center line.

2.5 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

A. Manufacturer:

1. Flexicraft Industries: www.mercer-rubber.com.
2. Metraflex Company: www.metraflex.com.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Inner Hose: Bronze.

C. Exterior Sleeve: Braided bronze.

D. Pressure Rating: 125 psi and 450 degrees F.

E. Joint: As specified for pipe joints.

F. Size: Use pipe sized units.

G. Maximum offset: 1 inch on each side of installed center line.

H. Application: Copper piping.

2.6 ACCESSORIES

A. Pipe Alignment Guides:

1. Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3 inches travel.

B. Swivel Joints:

1. Bronze body, double ball bearing race, field lubricated, with rubber (Buna-N) O-ring seals.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions. Refer to Plumbing details for additional requirements.

B. Install in accordance with EJMA (Expansion Joint Manufacturers Association) Standards.

C. Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.

D. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

E. Anchor pipe to building structure where indicated. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.

F. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required. Provide Thermal Expansion fittings on all hot and hot water return piping segments exceeding 50 ft. in lengths and at intervals not to exceed 100ft. Manufacturer of expansion fittings shall provide calculations to verify suitability for individual applications.

G. All expansion fittings for natural gas service, shall be A.G.A. certified.

H. Provide seismic restraints in conjunction with seismically designed flexible connectors at all locations where piping crosses building seismic expansion joints.

I. Provide nested loops where required by available space.

END OF SECTION 22.0516

SECTION 22.0519 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pressure gages and pressure gage taps.

B. Thermometers and thermometer wells.

1.2 RELATED REQUIREMENTS

A. Section 22 0100 - General Provisions

1.3 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; The American Society of Mechanical Engineers; 2005.

B. ASTM E 1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2007.

C. ASTM E 77 - Standard Test Method for Inspection and Verification of Thermometers; 2007.

D. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

C. Project Record Documents: Record actual locations of components and instrumentation.

1.5 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

1.6 EXTRA MATERIALS

A. See Section 01 6000 - Product Requirements. for additional provisions.

B. Supply two spare gauges of each type and pressure range installed.

C. Supply two spare thermometers of each type and pressure range installed.

PART 2 - PRODUCTS

2.1 PRESSURE GAGES

A. Manufacturers:

1. Dwyer Instruments, Inc: www.dwyer-inst.com.
2. Moeller Instrument Co., Inc: www.moellerinstrument.com.
3. H.O. Trerice: www.trerice.com
4. Omega Engineering, Inc: www.omega.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Pressure Gages: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background. Pressure gauges installed in domestic water piping shall conform with the Lead free requirements of the Safe Water Drinking Act and NSF-372.

1. Case: Cast aluminum with phosphor bronze bourdon tube.
2. Size: 4-1/2 inch diameter.
3. Size: 2 inch diameter.
4. Mid-Scale Accuracy: One percent.
5. Scale: Psi.
6. Basis of Design: H.O. Trerice Model 620B

2.2 PRESSURE GAGE TAPPINGS

A. Isolation valve: provide gage tapping valve

1. Gage Cock: Tee or lever handle, brass for maximum 150 psi.

B. Pressure Snubber

1. Lead Free Brass, NSF-61 compliant, connection size to match gauge connection

2.3 STEM TYPE THERMOMETERS

A. Manufacturers:

1. Dwyer Instruments, Inc: www.dwyer-inst.com.
2. Omega Engineering, Inc: www.omega.com.
3. H.O. Trerice: www.trerice.com
4. Weksler Glass Thermometer Corp: www.wekslerglass.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E 1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane. Thermometers installed in domestic water piping shall conform with the Lead free requirements of the Safe Water Drinking Act and NSF-372.

1. Size: 9 inch scale.
2. Window: Clear Lexan.
3. Stem: 3/4 inch NPT brass.
4. Accuracy: 2 percent, per ASTM E 77.
5. Calibration: Degrees F.
6. Basis of Design: H.O. Trerice Model BX9-403

2.4 PORTABLE TEST KIT/PLUGS

A. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F.

B. Test Kit: Carrying case, internally padded and fitted containing one 2-1/2 inch diameter pressure gages, one gage adapters with 1/8 inch probes, two 1 inch dial thermometers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide pressure gauges before strainers and on suction and discharge of each pump.

C. Provide pressure gauge and thermometer on outlet of each water heater.

D. Provide pressure gauge at each water service entrance riser.

E. Provide pressure gauges and thermometer at all recirculation pump installations and as detailed on the plumbing drawings.

F. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

G. Provide instruments with scale ranges selected according to service with largest appropriate scale.

H. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical, and in accordance with manufacturers recommendations.

I. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

J. Locate test plugs adjacent thermometers and thermometer sockets.

3.2 SCHEDULES

A. Pressure Gages, Location and Scale Range:

1. Domestic Water Pumps, 0 to 100 psi.
2. Sprinkler system, 0 to 250 psi.
3. Backflow preventers, 0 to 100 psi.

B. Stem Type Thermometers, Location and Scale Range:

1. Domestic hot water supply and recirculation, 0 to 200 degrees F.

END OF SECTION 22.0519

SECTION 22.0548 - VIBRATION ISOLATION & SEISMIC MOUNTINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Seismic Restraint & Mountings

B. Vibration Isolation

1.2 SUMMARY

A. The extent of vibration isolation and seismic mounting work is indicated by Drawings and schedules and by requirements of this Section.

B. The types of vibration isolation and seismic mounting work specified in this Section include the following:

1. Support and vibration isolation and restraints for motor driven equipment.
2. Support and vibration isolation and restraints for equipment, piping and piping risers.
3. Flexible connections for piping at vibration isolated equipment.
4. Seismic support isolation and restraints for equipment, piping and piping risers.

1.3 SUBMITTALS

A. Refer to Division 01 Specifications for Submittal Procedures.

B. The Manufacturer of vibration isolation and seismic restraints products shall submit the following data clearly marked on the submittal drawing. Each piece of isolated equipment shall be clearly identified, as well as the quantity and type of vibration isolators and seismic restraints.

C. Weight and center of gravity of each piece of isolation equipment, and RPM of each piece of rotating isolated equipment. When equipment center of gravity is not available, assumed locations for center of gravity shall be identified in submittals.

1. Calculated static load on each isolator.
2. Calculated deflection for each piece of isolated equipment.
3. Calculated seismic loads, for each restraint including horizontal and vertical forces and overturning moments.

D. Submittals for mountings and hangers incorporating springs shall include spring diameters, rated deflections, spring free height, solid spring height and spring color code.

E. Submittals for bases shall clearly identify locations for all mountings, as well as all locations for attachment points of the equipment to be mounting base. Installation instructions shall be included.

F. Submittals shall include seismic calculations signed and checked by qualified licensed Engineers in the employ of the Manufacturer of the vibration isolators. Catalog cut sheets shall be included for each type of mounting used on equipment being isolated.

1. Manufacturer's certification of components seismic acceleration operational capacity and attachment.

1.4 QUALITY ASSURANCE

A. Product Qualification: Provide each type of vibration isolation and seismic mounting unit produced by a specialized manufacturer, with not less than 5 years successful experience in the production of units similar to those for the project.

B. Except as otherwise indicated obtain support isolation units from a single manufacturer.

C. Engage the manufacturer to provide technical supervision of the installation of support isolation units and restraints produced by him, and of associated inertia bases.

D. Manufacturer: Provide vibration isolation and seismic mounting units manufactured by the following:

1. Amber/Booth
2. Consolidated Kinetics Corp.
3. Vibration Mountings and Controls, Inc./Korfund Dynamics
4. Mason Industries
5. Vibration Eliminator Co.

E. After installation is complete and while the system is operating, the vibration isolation Manufacturer and/or his qualified Representative shall conduct an inspection of the installation with the Contractor. The Representative will submit a written inspection report detailing any discrepancies, the Representative shall submit a report so stating. If there are discrepancies, the report shall detail corrective work to be done.

F. The Contractor shall employ the services of a licensed Professional Engineer registered in the Commonwealth of Pennsylvania to design, submit, and supervise the installation of seismic restraining and mountings products applicable to all equipment and piping systems installed by the Contractor.

G. Submit detailed seismic drawings, drawn to the scale indicated, for each of the following installations. All seismic drawings shall be based on the Architectural and Structural Contract Drawings. All seismic drawings shall bear the stamp of a Professional Engineer licensed in the state of the Project site:

1. Mechanical Equipment rooms depicting size and location of concrete housekeeping pads and the location and type of seismic restraints. Minimum Scale: 1/4"=1'-0".
2. Piping Plans depicting location and type of seismic restraints. Minimum Scale: 1/8"=1'-0".
3. Concrete pad details depicting location and size of reinforcing, doweling, and anchor bolts for each specific piece of equipment. Minimum Scale: 1/2"=1'-0".
4. Suspended equipment depicting restraint locations, types, and methods of attachment. Minimum Scale: 1/8"=1'-0".
5. Miscellaneous Attachment Details depicting size, locations, and types of attachment (i.e., bolts, welds, anchors, cables) for securing equipment to seismic mountings and for securing seismic mountings to the building structure.

H. Submit a seismic design errors and omissions insurance certificate. (Manufacturers product liability insurance certificates are not acceptable.

1.5 DESIGN - VIBRATION ISOLATION SYSTEMS

A. Vibration isolators shall be selected based on known or estimated operating weight distributions of the isolated equipment, with the quantity and location as shown on the components Drawings. Isolator type shall be tabulated for each isolated piece of equipment.

B. Isolators shall have either known non-deflected heights of spring element or calibration markings so that, after adjustment, when carrying their load, the deflection under load can be verified to determine if the load is within the proper range of the isolator and if the correct degree of vibration isolation is being provided.

C. Isolators shall function in the linear portion of the load versus deflection curve. Theoretical vertical natural frequency shall not differ from the design objectives by more than +10%.

D. Vibration isolation available internal to the equipment shall not be considered equivalent, and may only be used where it can be shown not to compromise the strength or performance of the entire system.

E. Unless otherwise specified, all isolated equipment and all piping shall be seismically restrained in accordance with requirements contained herein. All un-isolated mechanical equipment shall be adequately secured to the structure.

F. Unless the equipment incorporates unit construction using an integral unit frame or is specified otherwise, each item of mechanical equipment, along with its drive unit, shall be mounted on a rigid steel or steel and concrete base. The equipment, including the base, shall be mounted on, or suspended from, vibration isolators to prevent the transmission of vibration and mechanically transmitted structure borne sound to the supporting structure.

G. Isolation hangers shall be used for all piping in equipment rooms or for 50 ft. from vibration equipment, whichever is greater. To avoid reducing the effectiveness of equipment isolators, at least three of the first hangers from the equipment should provide the same deflection as the equipment isolators, with a maximum limitation of 2 inch deflection. The remaining hangers shall be spring or combination spring and rubber with a minimum of 0.75 in deflection. To prevent load transfer to the equipment flanges when the piping system is filled, the first three hangers adjacent to the equipment shall be the positioning type (specification type 5). Floor supports for piping in equipment rooms and adjacent to isolated equipment shall use restrained vibration isolators. They should be selected according to the guidelines for hangers.

1.6 DESIGN - SEISMIC RESTRAINTS

A. The site is classified as follows: Design Category "C"; International Building Code 2015 and ASCE 7-10 Table 11.6-1 & Pg. 56.

B. The Building Occupancy Risk Category is Category IV *(Hospital, Emergency Response, Fire, Police)* per ASCE 7-10 Table 1.5-1 Pg. 2.

C. Seismic restraint shall be required for the following installations:

1. *(Seismic Design Category C - Risk Category IV)* All Plumbing equipment, all gas piping and gas fired equipment.

D. Internally isolated equipment in lieu of specified isolation and restraint system must include certification by the equipment manufacturer that the internal isolation system meets the specified isolation and system restraint criteria. Equipment resiliently mounted on spring or pad type isolators shall be provided with seismic restraints or snubbers. Where required by code, seismic restraints for equipment mounted on vibration isolated curbs shall consist of slack galvanized or stainless steel cables (Type 16), attached to a structurally sound element of the equipment.

E. Each piece of isolated equipment shall receive a minimum of four all-directional restraint/snubbers, located as close to the equipment corners as practical. These shall consist of either restrained isolators or free standing isolators with separate snubbers. All snubbers shall have an impact surface consisting of a high quality elastomer. The elastomer shall be easy to inspect for damage, shall be replaceable and shall be a minimum of 3/4 inch thick.

F. Calculations by the Manufacturer's qualified licensed Engineer substantiating the mounting system, seismic restraints and recommended anchor bolts shall be submitted for approval along with the mechanical Drawings. Minimum spacing of anchor bolts, as well as location from edges of structure or concrete, shall be identified.

G. Unless otherwise specified, all equipment piping shall be restrained to resist seismic forces. Restraints shall maintain mechanical equipment or piping in a captive position. Restraint devices shall be designed and selected to meet seismic requirements as defined in IBC.

H. Anchor bolt calculations, signed by a qualified licensed Engineer, shall be submitted showing adequacy of bolt sizing and type. Calculations shall be furnished for anchors on restraint devices, cables, isolated and rigidly mounted equipment. Calculations shall specify anchor bolt type, embedment, concrete compressive strength, minimum spacing between anchors, and minimum distances of anchors from concrete edges. Concrete anchor locations shall not be near edges, stress joints, or an existing fracture. Embedded bolt locations and spacing shall conform to The International Building Code. All bolt shall be ASTM A307 or better.

PART 2 - PRODUCTS

2.1 GENERAL

A. Unless otherwise specified, all hardware shall be stainless steel or zinc plated. Springs with a deflection of up to 2 inches shall be zinc plated, or coated with a polyester epoxy powder. Springs with a rated deflection capability greater than 2 inches may be painted. Zinc plating shall conform to ASTM B633, CLASS 2 SC2, minimum.

2.2 TYPE 7 MOUNTINGS - PRE-COMPRESSED HANGERS

A. Spring-Flex hangers shall consist of a color coded steel spring in series with a neoprene element molded in specific colors for proper identification of rated load capacity. Springs shall be pre-compressed to the rated deflection so as to support the suspended equipment or piping at a fixed elevation during installation regardless of load changes. For 30 degree misalignment capability, spring diameters and hanger box lower hole sizes shall be of sufficient size to permit the hanger rod to swing approximately 30 degrees before contacting the box.

B. Springs shall be coated with a polyester epoxy powder. Hardware shall be stainless steel, or zinc plated. Steel housings shall be painted or galvanized.

C. Spring-Flex hangers shall be Series RSHPR or RSHPR-30A for 30 degree misalignment capability, as manufactured by Vibration Mountings and Controls, Inc.

2.3 TYPE 8 MOUNTINGS - SPRING HANGERS

A. Spring-Flex hangers shall consist of a color coded steel spring with a neoprene and steel washer which will properly distribute the load on the spring. For 30 degree misalignment capability, spring diameters and hanger box lower hole sizes shall be of sufficient size to permit the hanger rod to swing

approximately 30 degrees before contacting the box. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Hangers where are to be used with flat iron duct straps will be provided with eye bolts on both ends.

B. Springs shall be coated with a polyester epoxy powder. Hardware shall be stainless steel, or zinc plated. Steel housings shall be painted or galvanized.

C. Spring-Flex hangers shall be Series SH or SH-30A for 30 degree misalignment capability, as manufactured by Vibration Mountings and Controls, Inc. Hangers with eyebolts to be Type SHSC or SHSC-30A for 30 degree misalignment capability, as manufactured by Vibration Mountings and Controls, Inc.

2.4 TYPE 10 MOUNTINGS - FLOOR, WALL, AND CEILING SLEEVES

A. Where piping passes through walls, floors, or ceilings, a vibration control sleeve shall be provided to reduce the transmission of vibration. The sleeve shall consist of two pipe halves with neoprene sponge material bonded to the inside and a bolting arrangement for secure fit around piping. Where temperature exceeds 240 degrees F., an appropriate density fiberglass shall be used in place of neoprene material.

B. Sleeve shall be type VCS as manufactured by Vibration Mountings and Controls, Inc.

2.5 TYPE 11 MOUNTINGS - RESILIENT PIPE GUIDES:

A. Where vertical piping runs between support points, a resilient pipe guide shall be provided. The guide shall consist of an angle frame and four double deflection neoprene mountings molded in specific colors for proper identification of rated load capacity.

B. Resilient Pipe Guide shall be type RPG as manufactured by Vibration Mountings and Controls, Inc.

2.6 TYPE 12 MOUNTINGS - PIPE ANCHORS

A. Multi-directional pipe anchor shall consist of suitable steel sections in series with heavy duty duck and neoprene material assembled in a telescopic housing to provide the necessary restraint in both the vertical and horizontal directions. Pipe anchor shall be sized to limit load on neoprene and duck material to 500 psi.

B. Multi-directional Pipe Anchor shall be type MDPA as manufactured by Vibration Mountings and Controls, Inc.

2.7 TYPE 13 - FLEXIBLE CONNECTORS

A. Install Quiet-Sphere Flexible Connectors at the suction and discharge of each pump. The connectors shall be molded in spherical design of multiple layers of neoprene and synthetic fiber with integral corrosion resistant plate steel flanges. The connectors shall be suitable for pressures up to 214 psi and temperatures up to 240 degrees F. Where piping is not anchored, control rods must be installed at each connector to limit movement within their specified limits.

B. Flexible connectors shall be Quiet-Sphere Type VMS, VMT, or VMU as manufactured by Vibration Mountings & Controls, Inc.

2.8 TYPE 14 - SEISMIC SPRINGS WITH INTERNAL RESTRAINTS

A. Steel spring isolator incorporating elastomeric snubbing in all directions. The snubber shall be adjustable in the vertical direction and allow a maximum of 1/4 inch travel in all directions before contacting the elastomer cushion.

B. Spring diameter shall be no less than 0.8 times the compressed height of the spring at rated load. Springs shall also have a minimum additional travel to solid equal to 50% of the rated deflection.

C. Housing shall have provision to adjust the rebound plate and to inspect the spring. Housing shall be of cast ductile iron, malleable cast iron or of welded steel construction. Gray iron casings are not permitted.

D. Springs shall be color coded for proper identification of rated load capacity. Springs shall be coated with a polyester epoxy powder. Hardware shall be stainless steel, or zinc plated.

E. Mounting shall be Series AEQM or AWMR as manufactured by Vibration Mountings & Controls, Inc.

2.9 TYPE 15 - SEISMIC SNUBBERS/RESTRAINTS

A. All-directional Seismic Snubbers shall include all directional elastomer elements, having a minimum elastomer thickness of 3/4 inch in all directions. Elastomers shall be easy to inspect and shall consist of replaceable elastomer inserts. Elastomer shall be neoprene or a high quality rubber including anti-ozone and anti-oxidant materials. For installations where the expected temperature range is -20 degrees F. to +180 degrees F., the elastomer shall be neoprene conforming to either:

1. ASTM D2000 Grade 2BC; or Bridge Bearing Neoprene.

B. For installations where the expected operating temperature range can be as low as -65 degrees F. or a high as +300 degrees F., the elastomer shall be Ethylene Propylene Diene Monomer (EPDM) conforming to ASTM D2000.

C. Snubbers shall be manufactured with an air gap between steel and elastomer of 1/8 inch to 1/4 inch. Snubbers shall be installed with factory set clearances.

D. Snubber must have at least two anchor bolt holes and shall have an ultimate load capacity of at least four times the rated static load capacity.

E. Seismic Snubber shall be Seismic Restraint Series SR/SRD as manufactured by Vibration Mountings & Controls, Inc.

2.10 TYPE 16 - CABLE RESTRAINTS

A. Steel aircraft cable restraints are designed and installed to limit motion on suspended isolated equipment, piping or ducting. Cables are installed with enough slack to engage only when 1/4 movement occurs. On suspended equipment, cables are installed in sets of four, located at 45 degree angles to all three axes. Where required at pipe hangers, cables are placed two at each location, alternating orientation at successive locations.

B. Cables shall be 7 x 19 galvanized or stainless steel aircraft cable conforming to FED-STD-RR-W-410D. Cable diameters shall be available in at least three sizes to provide cost effective method of support for a wide range of supported loads.

C. Seismic cable restraints shall be Series SCR as manufactured by Vibration Mountings & Controls, Inc.

2.11 TYPE 17 - ELASTOMER MOUNTINGS

A. Consists of a captive elastomeric mount molded from neoprene or EPDM compound conforming to the requirements of ASTM D2000. Load bearing elastomer element shall be housed in either a heat treated cast aluminum housing or machined structural plate.

B. Mount shall incorporate a fail-safe captive design, and shall provide a vertical natural frequency of 15 Hz to 25 Hz, depending upon the static load. Mount shall be capable of providing dynamic deflections of up to .12 inches.

C. Use Vibration Mountings & Controls Series RB1, RB3 or RB4 with structural plate or MB1 or MB3 (aluminum housing).

PART 3 - EXECUTION

3.1 PERFORMANCE OF VIBRATION ISOLATORS AND SEISMIC RESTRAINTS

A. The manufacturer shall warrant the selection, sizing, and application of all vibration isolators and seismic restraints for each application.

B. The seismic engineer shall supervise and review the installation of all seismic restraints.

3.2 APPLICATIONS

A. General: Except as otherwise indicated, apply the following types of vibration isolators and seismic restraints for the indicated items of Equipment.

B. Vibration Isolation

1. Provide vibration isolation on each side of pumps and inline motor driven equipment.

C. Seismic Restraint Schedule

1. Piping Restraints: Applicable for threaded, welded, soldered, and grooved piping; schedule 10, 20, 40 and 80: Install cable restraints at maximum intervals of 40 ft. for transverse bracing and 80 ft. for longitudinal bracing, and at each change in direction. Actual spacing shall be determined by the seismic engineer.
2. Flexible Pipe Connectors: Install in piping systems at the following locations:
3. Connections, 3/4" pipe size and larger, with vibration isolation mounted equipment.

3.3 INSTALLATION

A. Isolation and seismic restraint systems shall be installed in strict accordance with the Manufacturer's written instructions and submittal data. Locations of all vibration isolation products shall be selected for ease of inspection and adjustment, as well as for proper operation. Electrical and plumbing connections to vibration isolated equipment shall be flexible.

B. All vibration isolators shall be leveled and aligned squarely below the mounting points of the supported equipment. Isolators for equipment with bases shall be located on the sides of the bases which are parallel to the equipment shaft (generally, the long axis) unless this is not possible because of physical restraints.

C. Unless otherwise indicated, there shall be a minimum operating clearance of 1 inch between inertia bases or structural steel frames and the concrete housekeeping pad or floor beneath the equipment. The clearance space shall be checked by the Contractor to ensure that no construction debris has been left to short circuit or restrict the proper operation of the vibration isolation system.

D. Vibration isolation hangers shall be positioned as high as possible in the hanger rod assembly, and so that the hanger housings may rotate a full 360 degrees without touching any object. Hanger rods shall not contact any object which would short out the vibration isolation systems. Parallel running pipes

may be hung together on a trapeze which is isolated from the building. Do not mix vibration isolated and non-vibration isolated pipes on the same trapeze.

E. Attention must be paid to movements of piping caused be expansion and contraction.

F. For Seismic installations, all floor mounted equipment, whether isolated or not, shall be bolted or welded to the structure to resist seismic forces. Bolt attachments, diameter of inserts, embedment depth and weld length as shown on approved submittal Drawings, shall be followed in all respects.

G. Seismic restraints shall be installed after equipment is in operating position to assure design clearances are maintained.

3.4 EXAMINATION OF RELATED WORK

A. Installer of vibration isolation work shall observe the installation of other Work related to vibration isolation work, including work connected to vibration isolation work; and after completion of other related Work (but before Equipment startup), shall furnish a written report to the Engineer listing observed inadequacies for proper operation and performance of vibration isolation work. Report shall cover, but not necessarily be limited to the following:

1. Equipment installations (performed as Work of other Sections) on vibration isolators.
2. Piping connections including flexible connections.
3. Passage of piping which is to be isolated through walls and floors.
4. Do not start up Equipment until inadequacies have been corrected in a manner acceptable to vibration isolation installer.

3.5 NOISE AND VIBRATION

A. Particular care shall be exercised in the selection and installation of all Mechanical Equipment and components to attain reasonable noise levels in occupied spaces. In general, sound levels for various spaces shall be maintained in accordance with the recommendations of the ASHRAE Guide. Normally the classification of noise shall be by mutual agreement but should a dispute arise regarding sound levels after occupancy of the building, representative sound measurements shall be taken to determine the average noise level in the offending space.

3.6 VIBRATION ELIMINATION

A. Vibration isolation supports shall be supplied for all moving or rotating equipment. Supports by Vibration Mountings and Controls, Inc. or approved in advance equal, installed in accordance with manufacturer's recommendations, shall be used unless specified otherwise herein.

B. Rotating or moving machinery or equipment suspended from building structure shall be provided with approved resilient type suspension mounting with lock washer and double nuts.

C. The entire system shall operate free from objectionable vibrations, to the satisfaction of the Engineer.

3.7 SOUND ISOLATION

A. All Equipment and piping shall be installed so that no noise or vibration is transmitted to any part of the building beyond the room or rooms in which such noise or vibration is generating. Moving equipment shall be isolated from the concrete foundations or floors by cork where required to prevent transmission of noise of vibration.

B. Silencers shall be installed in water connections to quick closing devices. Shock absorbers shall be used in all pipe lines where required to eliminate noise.

C. Any and all other insulation or isolation required to accomplish the results specified above shall be furnished and installed without additional cost to the Owner.

3.8 INSPECTION

A. Upon completion of installation of all vibration isolation and seismic restraint devices, a certification report prepared by the Seismic Engineer shall be submitted in writing to the contractor indicating that all systems are installed properly and in compliance with the specifications. The report must identify those areas that require corrective measures or certify that none exists. Any field coordination type changes to the originally submitted seismic restraint designs must be clearly defined and detailed in the report.

END OF SECTION 22.0548

SECTION 22.0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe Markers.

1.2 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

1.3 SUBMITTALS

A. Labelling List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

E. Project Record Documents: Record actual locations of tagged valves.

PART 2 - PRODUCTS

2.1 GENERAL

A. Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified or schedule. Provide numbers, lettering and working as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.

B. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples: (Standpipe F12)

C. Manufacturers

1. Advanced Graphic Engraving: www.advancedgraphicengraving.com.
2. Brady Corporation: www.bradycorp.com.
3. Brimar Industries: www.brimar.com
4. Champion America, Inc: www.Champion-America.com.
5. Kolbi Pipe Markers: www.kolbipipemarkers.com

6. Seton Identification Products: www.seton.com/aec.

2.2 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.

1. Letter Color: White.
2. Letter Height: 1/2 inch.
3. Background Color: Black.

2.3 VALVE TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black piping system abbreviation (1/4" high lettering) and sequenced valve numbers (1/2" high lettering), light contrasting background color and with 5/32" hole for fastener. Tag size minimum 1-1/2 inch diameter.

B. Valve Tag Fasteners: Manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

C. Valve Schedule: Provide valve schedule for each piping system, typewritten and reproduced on 8-1/2" x 11" bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags" in margin of schedule. In addition to mounted copies, furnish extra copies for Maintenance Manuals as specified in Division 1.

1. Frame: For each page of the valve schedule, provide a glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with SSB grade sheet glass.

2.4 PIPE MARKERS

A. Comply with ASME A13.1.

B. Plastic Pipe Markers: Provide manufacturer's standard preprinted, flexible or semi rigid, permanent, color coded, plastic sheet pipe markers, complying with ANSI A13.1. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

1. All Piping: Provide snap-on application of pre-tensioned semi-rigid plastic full-bank pipe markers, extending 360 degrees around pipe at each location.
2. Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by Architect/Engineer in cases of variance with names as shown or specified.
3. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastics.

2.5 UNDERGROUND PLASTIC PIPE MARKERS:

A. Description: Manufacturer's standard 2" wide warning tape color coded and labeled to match pipe identification labels. Material shall be detectable polyester complying with ASTM B-721.

2.6 CEILING TACKS

A. Description: Self-adhesive plastic coded dots. Color coded to match color of pipe marker.

PART 3 - EXECUTION

3.1 PREPARATION

A. Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of coverings and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment. Degrease and clean all surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Piping System Identification:

1. Install pipe markers on each system indicated to receive identification, and include arrows to show normal direction of flow:
2. Plastic pipe markers, with application system as indicated under "Products" in this section.
3. Locate pipe markers and color bands on all piping within mechanical rooms, accessible maintenance spaces, and above acoustic tile ceilings. Where piping is exposed to view in occupied/finished spaces, verify identification requirements with Architect in field prior to installation. Locate additional pipe markers in each of the following locations.
    a. Near each valve and control device.
    b. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
    c. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
    d. At access doors, manholes and similar access points which permit view of concealed piping.
    e. Near major equipment items and other points of origination and termination.
    f. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment. On piping above removable acoustical ceilings, omit intermediately spaced markers.
4. Provide underground warning tape for all underground piping outside the building approximately 6-8 inches below finish grade.

B. Valve Identification:

1. Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibs, and shut-off valves at plumbing fixtures, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.
2. Mount valve schedule frames and schedules in machine rooms where indicated or, of not otherwise indicated, where directed by Architect/Engineer.

3. Provide valve finder ceiling dots at all concealed valve locations. Locate on ceiling grid not on ceiling tile.

C. Mechanical Equipment Identification:

1. General: Install engraved plastic laminate nameplate on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:
   a. Main control and operating valves, including safety devices and hazardous units such as gas pressure regulators.
   b. Tanks and pressure vessels.
   c. Domestic water heaters
   d. Domestic water pressure booster pumps
   e. Recirculation pumps
   f. Sewage and Stormwater ejectors

END OF SECTION 22.0553

SECTION 22.0719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.

1.2 RELATED SECTIONS

A. Section 078400 - Firestopping.

B. Section 099000 - Painting and Coating: Painting insulation jacket.

C. Section 221005 - Plumbing Piping: Placement of hangers and hanger inserts.

1.3 REFERENCES

A. ASTM C 177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus; 2004.

B. ASTM C 534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2005.

C. ASTM C 547 - Standard Specification for Mineral Fiber Pipe Insulation; 2006.

D. ASTM C 552 - Standard Specification for Cellular Glass Thermal Insulation; 2003.

E. ASTM C 795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2003.

F. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2005.

G. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials; 2005.

H. IECC - ICC - International Energy Conservation Code

I. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; 2003.

1.4 SUBMITTALS

A. See Division 01 specifications for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum THREE years of experience.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

2.2 GLASS FIBER

A. Manufacturers:

1. Knauf Fiber Glass: www.knaufusa.com.
2. Johns Manville Corporation: www.jm.com.
3. Owens Corning Corp: www.owenscorning.com.
4. CertainTeed Corporation: www.certainteed.com.
5. Substitutions: See Section 016000 - Product Requirements.

B. Insulation: ASTM C 547 and ASTM C 795; rigid molded, noncombustible.

1. 'K' value: ASTM C 177, 0.24 at 75 degrees F.
2. Maximum service temperature: 850 degrees F.
3. Maximum moisture absorption: 0.2 percent by volume.

C. Insulation: ASTM C 547 and ASTM C 795; semi-rigid, noncombustible, end grain adhered to jacket.

1. 'K' value: ASTM C 177, 0.24 at 75 degrees F.
2. Maximum service temperature: 650 degrees F.
3. Maximum moisture absorption: 0.2 percent by volume.

D. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E 96/E 96M of 0.02 perm-inches.

E. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

F. Vapor Barrier Lap Adhesive:

1. Compatible with insulation.

G. Insulating Cement/Mastic:

1. ASTM C 195; hydraulic setting on mineral wool.

2.3 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:

1. Armacell International: www.armacell.com.
2. Substitutions: See Section 016000 - Product Requirements.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C 534 Type I, Tubular Grade 1; ASTM E 84/ UL 723 25/50 rated for use in return air plenums, use molded tubular material wherever possible. ArmaFlex Ultra or approved equal.

1. Thermal Conductivity: 0.27 Btu-in/hr-ft2-degF @ 75 deg.F Mean Temp
2. Minimum Service Temperature: -40 degrees F.
3. Maximum Service Temperature: 220 degrees F.
4. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.4 PLENUM INSULATION

A. Manufacturer

1. Unifrax Corporation
2. Substitutions: See Section 016000 - Product Requirements.

B. Insulation: Fyrewrap .5 plenum insulation, high temperature, bio-soluble insulation, aluminum foil/fiberglass reinforced scrim encapsulated

2.5 JACKETS

A. PVC Plastic.

1. Manufacturers:
   a. Johns Manville Corporation: www.jm.com.
   b. Substitutions: See Section 016000 - Product Requirements.
2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
   a. Minimum Service Temperature: 0 degrees F.
   b. Maximum Service Temperature: 150 degrees F.
   c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E 96/E 96M.
   d. Thickness: 10 mil.
   e. Connections: Brush on welding adhesive.

B. Stainless Steel Jackets

1. Standards:
   a. ASTM-A240 and A666 Standards
2. Thickness
   a. .016” (.4mm)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:

1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. For hot water piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

G. Glass fiber insulated pipes conveying fluids above ambient temperature:

1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

H. Inserts and Shields:

1. Provide shields (Piping 1 inch diameter or larger.): Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
2. Provide inserts (Piping 1 inches diameter or larger.): Between support shield and piping and under the finish jacket.
    a. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
    b. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 078400.

J. Exposed Insulated Pipe: (from finish floor level to 10 feet above finished floor): Provide with Stainless Steel jacket around entire pipe/insulation circumference

K. Provide UL listed plenum insulation on all piping not conforming to the 25/50 smoke and flame requirements for combustibility as required by the International Mechanical code, and installed within return air plenum spaces.

3.3 SCHEDULES

A. Plumbing Systems: (Provide insulation for piping and appurtenances of the following Plumbing systems as scheduled below)

1. Domestic Cold Water Supply:
   a. Glass Fiber Insulation (w/All-Service Jacket):
      1) Thickness:
         (a) All pipe sizes: 1-inch thick
   b. Flexible Elastomeric Cellular Insulation (underground piping, piping installed in masonry walls):
      1) Thickness:
         (a) All pipe sizes: 1-inch thick
2. Domestic Hot, Hot Return, 140F Hot, and 140F Return Water Supply:
   a. Glass Fiber Insulation (w/All-Service Jacket):
      1) Thickness:
         (a) Pipe sizes up to and including 1-1/4-inch: 1-inch thick
         (b) Pipe sizes 1-1/2"-inch - 6"-inch: 1-1/2 inch thick
   b. Flexible Elastomeric Cellular Insulation (underground piping, pipe installed in masonry walls):
      1) Thickness:
         (a) Pipe sizes up to and including 1-1/4-inch: 1-inch thick
         (b) Pipe sizes 1-1/2"-inch - 6"-inch: 1-1/2 inch thick
3. Tempered Domestic Water Supply:
   a. Glass Fiber Insulation (w/All-Service Jacket):
      1) Thickness::
         (a) All pipe sizes: 1-inch thick
4. Non-Potable Water:
   a. Glass Fiber Insulation (w/All-Service Jacket):
      1) Thickness::
         (a) All pipe sizes: 1-inch thick
   b. Flexible Elastomeric Cellular Insulation (underground piping, pipe installed in concrete walls):
      1) Thickness:
         (a) All pipe sizes: 1-inch thick
5. Roof Drain and Emergency Roof Drain Bodies:
   a. Glass Fiber Insulation:
      1) 1-inch thick for Glass Fiber
         (a) Where service is concealed Flexible Elastomeric insulation in factory color is adequate. In exposed, finished areas (i.e. gymnasium, auditorium, etc.) painted Glass Fiber with jacket is required (color selected by Architect).

6. Rainwater and Emergency Rainwater Drainage Piping Above Grade (all horizontal and all vertical piping):
    a. Glass Fiber Insulation (w/All-Service Jacket):
        1) Pipe Size Range:
            (a) all pipe sizes: 1 -inch thick
7. Cold Condensate Drains:
    a. Flexible Elastomeric Insulation:
        1) 1-inch for all pipe sizes.

END OF SECTION 22.0719

SECTION 22.1005 - PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe, Pipe Fittings, Pipe Hangers and Supports, Valves, and Miscellaneous connections for piping systems.

1. Waste/Sanitary Sewer & Vent.
   a. Contractor shall provide complete Sanitary drainage and vent piping system as shown on plumbing drawings and specified herein including but not limited to all: piping, pipe fittings, pipe supports, pipe anchors, drains, and equipment/fixture connections including final coordination and connection to Site Sanitary system.
2. Pumped/Forced Waste and Rainwater
   a. Contractor shall provide complete Forced Main piping systems as shown on plumbing drawings and specified herein including but not limited to all: piping, pipe fittings, pipe supports, pipe anchors, drains, including final coordination and connection to Water/Sanitary or Storm piping system as indicated on drawings.
3. Domestic Potable Water.
   a. Contractor shall provide complete Domestic Cold, Hot, and Hot Water Return, & Tempered water piping systems as shown on plumbing drawings and specified herein including but not limited to all: equipment, piping, valves, fittings, supports, anchors, insulation, connections to equipment/fixtures and plumbing specialties including final coordination and connection to Site Water supply.
4. Rainwater/Storm Water & Emergency Rainwater.
   a. Contractor shall provide complete Rainwater/Storm water piping system as shown on plumbing drawings and specified herein including but not limited to all: piping, pipe fittings, pipe supports, pipe anchors, drains, and insulation including final connection to Site Storm water system.
5. Condensate Drain Piping
   a. Contractor shall provide complete condensate drainage piping system as shown on plumbing drawings and specified herein including but not limited to all: piping, pipe fittings, pipe supports, pipe anchors, drains, and insulation t including final connection to Site Storm water system or discharge point as noted on the drawings.
6. Natural Gas
   a. Contractor shall provide complete Natural gas distribution system as shown on plumbing drawings and specified herein including but not limited to all: equipment, regulators, piping, valves, fittings, supports, anchors, connections to equipment/fixtures and plumbing specialties beginning at the outlet of gas service meter.
7. Compressed Air
   a. Contractor shall provide complete Compressed Air piping system as shown on plumbing drawings and specified herein including but not limited to all: equipment, piping, pipe fittings, pipe supports, and pipe anchors.

1.2 RELATED REQUIREMENTS

A. Section 07 8413 - Penetration Fireproofing

B. Section 08 3100 - Access Doors and Panels.

C. Section 09 9000 - Painting and Coating.

D. Section 22 0100 - General Provisions

E. Section 22 0516 - Expansion Fittings and Loops for Plumbing Piping.

F. Section 22 0548 - Vibration Isolation and Seismic Mountings.

G. Section 22 0553 - Identification for Plumbing Piping and Equipment.

H. Section 22 0719 - Plumbing Piping Insulation.

I. Section 22 1006 - Plumbing Piping Specialties

1.3 REFERENCE STANDARDS

A. Work and products provided in conformance to referenced standards listed below shall be in conformance with the latest editions of the referenced standards where the standards have a revision more current than the edition noted below.

B. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).

C. ASME B16.4 - Gray Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).

D. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2005) (ANSI B16.18).

E. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2005).

F. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2008 (ANSI/ASME B31.9).

G. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2007.

H. ASTM A 74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2006.

I. ASTM B 32 - Standard Specification for Solder Metal; 2004.

J. ASTM B 88 - Standard Specification for Seamless Copper Water Tube; 2003.

K. ASTM B 306 - Standard Specification for Copper Drainage Tube (DWV); 2002.

L. ASTM C 564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2003a.

M. ASTM D 1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2006.

N. ASTM D 2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2006.

O. ASTM D 2513 - Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings; 2007b.

P. ASTM D 2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2004.

Q. ASTM D 2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2008.

R. ASTM D 2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing; 2004.

S. ASTM D 2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2003.

T. ASTM D 2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings; 1996 (Reapproved 2002).

U. ASTM D 3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2006.

V. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; American Water Works Association; 2005 (ANSI/AWWA C105/A21.5).

W. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association; 2009 (ANSI/AWWA C151/A21.51).

X. AWWA C651 - Disinfecting Water Mains; American Water Works Association; 2005 (ANSI/AWWA C651).

Y. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; Cast Iron Soil Pipe Institute; 2005.

Z. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; Cast Iron Soil Pipe Institute; 2004.

AA. IBC - ICC - International Building Code

BB. IPC - ICC - International Plumbing Code

CC. IFGC - ICC - International Fuel Gas Code

DD. MSS SP-58 - Pipe Hangers and Supports - Materials, Design and Manufacture; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2009.

EE. MSS SP-69 - Pipe Hangers and Supports - Selection and Application; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.

FF. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2008.

GG. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.

HH. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 1996.

1.4 SUBMITTALS

A. In addition to the requirements of Division 01 specifications, plumbing product submittals shall be in accordance with the following:

1. Piping & Pipe fitting Product Data: Provide manufacturer's data on pipe materials and pipe fittings specified herein. Submittals shall clearly indicate exact materials to be provided and applications where the submitted product is to be installed and associated specification section. Manufacturer data shall indicate, material of construction, applicable standards and listings, design pressure and ratings, etc.
2. Hangers & Supports, Valve, & Misc. Product Data: Provide manufacturer's data for Hangers & supports, valve, & miscellaneous piping products specified herein. Clearly indicate exact models/model number, options, and accessories to be provided for each product. Submittals shall clearly indicate applications where the submitted product is to be used. Manufacturer data shall indicate, material of construction, applicable standards and listings, design pressure and ratings, etc.
3. Project Record Documents: Record actual locations of valves. Provide valve schedule as required in Section 22 0553 "Identification for Plumbing Piping and Equipment".
4. Maintenance Data: Submit maintenance data and spare parts lists for each type of valve. Include this data in Maintenance Manual.
5. Maintenance Materials: Furnish the following for Owners use in maintenance of project.
    a. See Section 01 6000 - Product Requirements, for additional provisions.
    b. Valve Repacking Kits: One for each type and size of valve.

B. Review of submittals which do not clearly indicate the information noted below may be delayed or Rejected due to lack of clarity or information. Generic catalog sheets with no indication of options, accessories, or model to be provided will be Rejected without further review. P.C. is responsible to review plumbing product submittals provided by suppliers and coordinate and verify all submittal information prior to submission to Architect/Engineer.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with State of Pennsylvania, UCC standards.

1. Maintain one copy on project site.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Piping

1. Welding Materials and Procedures: Conform to ASME (BPV IX) and applicable state labor regulations.
2. Welder Qualifications: Certified in accordance with ASME (BPV IX) or ANSI B3l.I as applicable.
3. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.
4. Manufacturers: Firms regularly engaged in the manufacture of piping products of types and sizes required, and which have been in satisfactory use for not less than five years in similar service.
5. Welding: Certify welding procedures, welders and operators in accordance with ANSI B3l.I, paragraph 527.5 for shop and job site welding of piping work.

6. All grooved joint couplings, fittings, valves, and specialties shall be the products manufactured by Victaulic Co. or America. Grooving tools shall be of the same manufacturer as the grooved components.
7. Cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.

D. Valves: Manufacturer's name and pressure rating marked on valve body.

1. Manufacturers: Firms regularly engaged in the manufacture of valves, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.
2. Marking of Valves: Comply with MSS SP-25.
3. Valve Dimensions; For face-to-face and end-to-end dimensions of flanged or welding-end valve bodies, comply with ANSI B16.10. Grooved end valves shall comply with manufacturer's published dimensional data, with grooved ends complying with ANSI/AWWA C606.
4. Valve Types: Provide valves of same type by same manufacturer.

1.6 REGULATORY REQUIREMENTS

A. Perform Work and inspections/testing in accordance with State of Pennsylvania UCC building codes including but not limited to IPC, IFGC, IBC, and IFC (Latest editions).

B. Conform to International Plumbing Code and all requirements of the local authority having jurisdiction/local Water Authority for installation of backflow prevention devices, service valving, and metering.

C. Submit product data for backflow prevention devices, service valving, and meters to the Municipal Water Authority prior to submission to Architect/Engineer. Obtain approval for devices and installation details and submit written approval with product data submittal to Architect/Engineer.

D. When a meter pit is required, provide certificate of compliance from the local water authority having jurisdiction indicating approval of water meter pit construction plans prior to order/installation of water meter pit and all associated piping.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Provide factory applied plastic end caps on each length of pipe and tube. Maintain end caps through shipping, storage and handling as required to prevent pipe end damage and eliminate dirt and moisture from outside of pipe and tube..

E. Where possible, store pipe and tube inside and protected from weather. Where necessary to store outside, elevate well above grade and enclose with durable waterproof wrapping.

F. Protect steel flanges and fittings from moisture and dirt by inside storage and enclosure or packaging with durable, waterproof wrapping.

1.8 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

1.9 EXTRA MATERIALS

A. See Section 01 6000 - Project Requirements, for additional provisions.

B. Provide two repacking kits for each size valve.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Except as otherwise indicated, provide factory fabricated products of the size, joint type, or class (thickness) indicated for each service. Where size, joint type, or class (thickness) is not indicated, provide products as determined by the installer for installation requirements and comply with the standards of the International Plumbing Code, International Fuel Gas Code, NFPA, Cast Iron Soil Pipe Institute (CISPI),and EPA as appropriate for each service.

B. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.2 WASTE/SANITARY SEWER & VENT PIPING, BELOW SLAB/GRADE AND BURIED WITHIN 5 FEET OF BUILDING

A. Epoxy Coated Cast Iron Soil Pipe: (High Temp drainage - Kitchens, Boiler rooms, etc.) ASTM A 74 service weight, Epoxy coated cast iron soil pipe, corrosion resistance from 2pH to 12pH, high temperature resistance to 250 degrees Fahrenheit, Epoxy coated cast iron soil pipe shall have a 5 year warranty.

1. Manufacturers:
   a. Charlotte Pipe and Foundry
   b. Tyler Pipe
2. Pipe Coating: Chemically deposited zinc-phosphate pretreatment layer followed by an electrically deposited, high performance cathodic epoxy coating, and finally an electrically deposited high performance anodic epoxy top coat.
3. Fittings: Cast iron, DWV, hub and spigot
   a. Fitting Coating: Chemically deposited zinc-phosphate pretreatment layer followed by an electrically deposited, high performance cathodic epoxy coating, and finally an epoxy acrylic powder top coat
4. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C 564 neoprene gaskets conforming to ASTM C 1563.

B. PVC Pipe: Schedule 40 ASTM D 2665 or ASTM D 3034. (No foam core permitted) - PVC Piping option for Sanitary Sewer and Waste piping systems shall not be permitted in areas with high temperature drainage discharge, these areas include but are not limited to: Kitchens, Boiler/Mechanical Rooms, etc. In areas with high temperature drainage discharge, Cast Iron Pipe shall be used in lieu of PVC piping. This cast iron pipe shall extend beyond the affected room/space to a minimum of 25ft. beyond the most downstream high temperature drain connection.

1. Manufacturers:
   a. Charlotte Pipe and Foundry
2. Fittings: PVC, DWV.

3. Joints: Solvent welded, with ASTM D 2564 solvent cement.

2.3 WASTE & VENT PIPING, ABOVE SLAB/GRADE

A. Cast Iron Pipe: CISPI 301, hubless.

1. Manufacturers:
   a. Charlotte Pipe and Foundry
   b. Tyler Pipe
2. Fittings: Cast iron, DWV, no-hub
3. Joints: Heavy Duty Couplings: ASTM C 1540/ASTM C 564/FM 1680 Class 1, neoprene gaskets and smooth 304 stainless steel clamp-and-shield assemblies with .010in minimum thickness corrugated shield, four clamps for sizes 1-1/2"-4", six clamps for sizes 5"-10", and worm gear drive clamps torqued to 80 inch pounds.

2.4 PUMPED WASTE/RAINWATER PIPING, ABOVE SLAB/GRADE

A. Steel Pipe: ASTM A 53/A 53M Schedule 40, galvanized, using one of the following joint types:

1. Flanged Joints: ASME B16.1 cast iron fittings.
2. Threaded Joints: ASME B16.3 malleable iron fittings.

2.5 DOMESTIC POTABLE AND NON-POTABLE WATER PIPING, ABOVE SLAB

A. Copper Tube: ASTM B 88 (ASTM B 88M), Type L (B), Drawn (H).

1. Fittings: Provide fittings from one of the options below. All fittings/components within the domestic potable water piping shall meet the Lead Free requirements of the Safe Drinking Water Act (Sec. 1417) amended 1-4-2011 (weighted average lead content = 0.25%) and other equivalent state regulations
   a. Soldered Fittings (all pipe sizes): ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   b. Copper Press Fittings (all pipe sizes): Double-pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, nontoxic, synthetic rubber sealing elements. fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22. Copper press fittings shall be manufactured by Viega and installed utilizing Rigid Tool Company as "Pro Press System" or equal system as approved by Engineer. Complete installation shall comply with manufacturers recommendations.
   c. Copper Plated Mechanical Grooved fittings (Pipe sizes larger than 2"): Mechanical grooved couplings for grooved piping as manufactured by Victaulic - No substitutions permitted.
2. Joints: Provide pipe joints from one of the options below.
   a. Solder Joints(All Sizes): ASTM B32, alloy Sn95 solder.
   b. Press Fit Joints(All Sizes): ProPress (as specified above)
3. Unions (Pipe Sizes 2" and Under):
   a. Copper tube and pipe: Class 150 bronze unions with soldered joints.
4. Flanges (Pipe Size Over 1 Inch):
   a. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

B. **Pex (Pex-A) Piping: Alternate for 1/2" to 2". Refer to 22116.**

2.6 DOMESTIC POTABLE AND NON-POTABLE WATER SERVICE PIPING BURIED BELOW SLAB/GRADE

A. Copper Tube (2 in. and smaller): ASTM B 88 (ASTM B 88M), Type K (A).

1. Fittings: No fittings permitted below grade
2. Joints: Flared

B. Ductile Iron Pipe (3 in. and Larger): AWWA C151/A21.51 cement/mortar lined in accordance with AWWA C104/A21.4

1. Fittings: AWWA C110/A21.10 standard thickness.
2. Joints: AWWA C111/A21.11rubber gasket.
3. Mechanically Restrained Couplings: Shaped composition sealing gasket, steel bolts, nuts, and washers. Bolts, nuts, washers, and threaded rod in buried applications shall be ASTM A193 Grade B7 studs, ASTM A194 grade 2H nuts, AND ASTM F436 hardened washers in accordance with AWWA C207 and zinc plated for corrosion resistance.

2.7 DOMESTIC POTABLE AND NON-POTABLE WATER PIPING, BELOW SLAB

A. Copper Tube: ASTM B 88 (ASTM B 88M), Type K (A).

1. Fittings: No fittings or joints permitted below grade
2. Joints: No fittings or joints permitted below grade

2.8 STORM PIPING, BELOW SLAB AND BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A 74 service weight. (Provide extra heavy weight where required by local Authority Having Jurisdiction).

1. Manufacturers:
   a. Charlotte Pipe and Foundry
   b. Tyler Pipe
2. Fittings: Cast iron, DWV pattern
3. Joint Seals: Hub-and-spigot, CISPI HSN compression type with ASTM C 564 neoprene gaskets conforming to ASTM C 1563, or lead and oakum.

B. PVC Pipe: ASTM D 2665 or ASTM D 3034. (No Foam Core Permitted)

1. Manufacturers:
   a. Charlotte Pipe and Foundry
   b. Spears
   c. Cresline
2. Fittings: PVC, DWV pattern
3. Joints: Solvent welded, with ASTM D 2564 solvent cement.
4. Transition: Use appropriate transition joints as required for connection to dissimilar piping materials. Transition from PVC below grade piping to cast iron pipe above grade shall occur 6" -12" above slab.

2.9 RAINWATER & EMERGENCY RAINWATER PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless.

1. Manufacturers:
   a. Charlotte Pipe and Foundry

b. Tyler Pipe

2. Fittings: Cast iron, DWV pattern
3. Joints: ASTMC-1540/ASTMC-564/FM 1680 Class 1, neoprene gaskets and smooth 304 stainless steel clamp-and-shield assemblies with .010in minimum thickness corrugated shield, four clamps for sizes 1-1/2"-4", six clamps for sizes 5"-10", and worm gear drive clamps torqued to 80 inch pounds.

2.10 NATURAL GAS PIPING, ABOVE SLAB

A. (Pipe Size 2" and Smaller) Steel Pipe: ASTM A 53/A 53M Schedule 40 black.

1. Fittings (threaded): ASME B16.3, malleable iron threaded
2. Fittings (Press Fit): Cold press mechanical joint fitting, ASTM A420 or ASME B16.3 and performance criteria of IAPMO PS117 and ASTM F3226, HNBR Sealing elements - Viega MegaPressG
3. Joints: NFPA 54, threaded
4. Unions: Class 150 malleable iron threaded unions.
5. Flanges: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.

B. (Pipe Size 2-1/2" and Larger) Steel Pipe: ASTM A 53/A 53M Schedule 40 black.

1. Fittings (welded): ASTM A 234/A 234M, wrought steel welding type.
2. Fittings (Press Fit): Cold press mechanical joint fitting, ASTM A420 or ASME B16.3 and performance criteria of IAPMO PS117 and ASTM F3226, HNBR Sealing elements - Viega MegaPressG
3. Joints: welded to ASME B31.1.
4. Flanges: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.

2.11 NATURAL GAS PIPING, BELOW SLAB

A. Pre-Sleeved Corrugated Stainless Steel Tube: Omegaflex, TracPipe PS-II

1. Fittings: Omegaflex, AutoFlare mechanical attachment fittings, yellow brass with sleeved vent connection extended to building exterior.

2.12 CONDENSATE DRAIN PIPING, BELOW SLAB

A. PVC Pipe: ASTM D 2665 or ASTM D 3034. (No Foam Core Permitted)

1. Fittings: PVC, DWV pattern
2. Joints: Solvent welded, with ASTM D 2564 solvent cement.

2.13 CONDENSATE DRAIN PIPING, ABOVE SLAB

A. Copper Pipe: Type DWV with soldered joints and fittings.

2.14 FLANGES, UNIONS, AND COUPLINGS

A. Unions (Pipe Sizes 2" and Under):

1. Ferrous pipe: Class 150 malleable iron threaded unions.
2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Flanges (Pipe Size Over 1 Inch):

1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Dielectric Unions/Connections: Provide standard products recommended by manufacturer for use in service indicated which effectively isolate ferrous from non-ferrous piping (electrical conductance), prevent galvanic action, and stop corrosion.

1. Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier
2. Manufacturer: Subject to compliance with requirements, provide dielectric unions of one of the following:
   a. Atlas Products Co.
   b. Capital Mfg. Co., Div. of Harsco Corp.
   c. Eclipse, Inc.
   d. Epco Sales, Inc.
   e. PSI Industries.
   f. Stockham Valves and Fittings.

2.15 MISCELLANEOUS PIPING FABRICATION MATERIALS:

A. Forged Branch Connection Fittings: Except as otherwise indicated, provide the type as determined by the installer to comply with installation requirements.

B. Pipe Nipples: Fabricate from same pipe as used for connected pipe; except do not use less than schedule 80 pipe where length remaining Unthreaded is less than 1 1/2", and where pipe size is less than 1 1/4", and do not thread nipples full length (no close nipples.)

C. Copper Tube Unions: Provide standard products recommended by the manufacturer for use in the service indicated.

D. Welding Materials: Except as otherwise indicated, provide welding materials as determined by the installer to comply with installation requirements. Comply with Section 2-C, ASME Boiler Code for welding materials.

E. Soldering Materials: Except as otherwise indicated, provide lead free soldering materials as determined by the installer to comply with installation requirements.

F. Tin-Antimony Solder: ASTM B32, Grade 95YA.

G. Gaskets for Flanged Joints: ANSI B16.21 full faced for cast iron flanges; raised face for steel flanges, unless otherwise indicated.

H. Gaskets for Grooved Joints: Pressure responsive, ASTM D-2000. Gaskets shall be verified as suitable for the intended service prior to installation. Gaskets shall be molded and produced by the coupling manufacturer.

2.16 PIPE HANGERS AND SUPPORTS

A. HORIZONTAL PIPING HANGERS AND SUPPORTS:

1. General: Except as otherwise indicated, provide factory fabricated horizontal piping hangers and supports of the MSS type and size indicated, bolts (if any) and washers; comply with MSS SP-58 and the manufacturer's published product information. Where the MSS type or size is not indicated, provide proper selection determined by installer for installation requirements, and comply with MSS SP-69 and the manufacturer's published product information: size hangers and supports properly for piping including insulation, for insulated piping systems..
   a. Adjustable Clevis Hangers: MSS-SP-69 Type 1, fabricated from steel. (Insulated or Non-insulated - Stationary piping systems)
   b. Adjustable Swivel Band Hangers: MSS-SP-69 Type 10 fabricated from steel. (Non-insulated - Stationary piping systems)
   c. Adjustable Roller Hangers: MSS-SP-69 Type 43, including axle roller and clevis.(Insulated or Non-insulated - Non-Stationary piping systems)
   d. Steel Brackets: Welded structural steel shapes complying with one of the following:
      1) Light Duty: MSS Type 31.
      2) Medium Duty: MSS Type 32.
      3) Heavy Duty: MSS Type 33.

B. VERTICAL PIPING CLAMPS:

1. General: Except as otherwise indicated, provide factory fabricated vertical piping clamps of the MSS type and size indicated; comply with MSS SP-58 and the manufacturer's published product information. Where the MSS type or size is not indicated, provide proper selection as determined by the installer for installation requirements, and comply with MSS SP-69 and the manufacturer's published product information. Size clamps properly for piping, including insulation (if any).
   a. Two Bolt Riser Clamp: MSS-SP-69 Type 8.
   b. Four Bolt Riser Clamp: MSS-SP-69 Type 42, including pipe spacers at inner bolt holes.

C. HANGER ROD ATTACHMENTS:

1. General: Except as otherwise indicated, provide factory fabricated hanger rod attachments of the MSS type and size indicated; comply with MSS SP-58 and the manufacturer's published product information. Where MSS type or size is not indicated, provide proper selection as determined by installer for installation requirements, and comply with MSS AP-69 and the manufacturer's published product information. Size attachments properly for piping, including insulation (if any).
   a. Turnbuckles: MSS-SP-69 Type 13.
   b. Weldless Eye Nut: MSS-SP-69 Type 17.
   c. Malleable Eye Socket: MSS-SP-69 Type 16.
   d. Clevises: MSS-SP-69 Type 14.

D. BUILDING ATTACHMENTS:

1. General: Except as otherwise indicated, provide factory fabricated building attachments of the MSS type and load rating indicated; comply with MSS SP-58 and the manufacturer's published

product information. Where the MSS type or load rating is not indicated, provide proper selection determined by installer for installation requirements, and comply with MSS SP-69 and the manufacturer's published information. Size units properly for piping loading.

a. Concrete Inserts: MSS-SP-69 Type I8, steel.
b. Top Beam C-Clamps: MSS-SP-69 Type I9.
c. C-Clamps: MSS-SP-69 Type 23, steel
d. Top I-Beam Clamp: MSS-SP-69 Type 25.
e. Side Beam Clamp: MSS-SP-69 Type 20.
f. Beam Clamp/Eye Nut: MSS-SP-69 Type 28.
g. Wide Flange Beam Clamp/Eye Nut: MSS-SP-69 Type 29.
h. Beam Clamp/Extension Piece: MSS-SP-69 Type 30.

E. SADDLES AND SHIELDS:

1. General: Except as otherwise indicated, provide factory fabricated saddles and shields of the MSS type and size indicated; comply with MSS SP-58 and the manufacturer's published product information. Where the MSS type or size is not indicated, provide proper selection determined by installer for installation requirements, and comply with MSS SP-69 and the manufacturer's published product information. Size saddles and shields properly for insulation and vapor barriers (if any).
   a. Protection Saddles: MSS-SP-69 Type 39.
   b. Protection Shields: MSS-SP-69 Type 40.
   c. Wood Insulation Saddle: Provide products manufactured by Elcen Metal Products Company.

F. RESTRAINTS

1. General: Provide No-Hub Cast Iron Joint restraints as required by local Plumbing Codes, CISPI Designation 310-11, and the 2006 CISPI Installation Handbook. 24 ga. CRS, galvanized straps, stainless steel bands and worm gear drive clamps.
   a. HoldRite Series #117

G. MISCELLANEOUS HANGER AND SUPPORT MATERIALS:

1. Metal Framing: Provide products complying with NEMA STD ML 1. Contractor shall provide all miscellaneous steel required for support of work within his contract.
2. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.
3. Cement Grout: Portland cement (ASTM C I50, Type I or Type III,) and cleaned uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of I.0 part cement to 3.0 parts sand, by volume, with only the minimum amount of water required for placement and hydration.
4. Heavy Duty Steel trapezes: Fabricate from steel shapes selected for the loads required, weld steel in accordance with AWS Standards.
5. Pipe Guides: Provide factory fabricated guides of cast semi-steel or heavy fabricated steel, consisting of a bolted two-section outer cylinder and base with a two sections guiding spider bolted tightly to the pipe. Size guide and spiders to clear pipe and insulation (if any), and cylinder. Provide guides of the length recommended by the manufacturer to allow indicated travel.

2.17 VALVES:

A. General: Provide factory fabricated valves recommended by manufacturer for use in service indicated. Provide valves of types and pressure ratings indicated; provide proper selection as determined by installer to comply with installation requirements. Provide sizes as indicated, and connections which properly mate with pipe, tube, and equipment connections.

B. All valves and specialties within the domestic potable water piping shall meet the Lead Free requirements of the Safe Drinking Water Act (Sec. 1417) amended 1-4-2011 (weighted average lead content = 0.25%), NSF/ANSI-61-8 Commercial Hot 180°F (including Annex F and G) and NSF/ANSI-372, and other equivalent state regulations.

C. All shutoff valves 4" and smaller within the domestic potable water piping shall be full port ball valve type unless noted otherwise.

D. General Valve Features:

1. General: Provide valves with features indicated and where not otherwise indicated, provide proper valve features as determined by installer for installation requirements. Comply with ANSI B31.1
2. Flanged: Valve flanges complying with ANSI B16,1 (cast iron), ANSI B16.5 (steel), or ANSI P16.24 (bronze).
3. Threaded; Valve ends complying with ANSI P2.1.
4. Grooved; Valve ends complying with ANSI/AWWA C606.
5. Solder Joint: Valve ends complying with ANSI P16.18.
6. Trim: Fabricate pressure-containing components of valve, including stems (shafts) and seats from bronze materials, of standard alloy recognized in the valve manufacturing industry that resists dezincification and meets the Lead free requirements
7. Non-Metallic Discs: Non-metallic material selected for service indicated in accordance with the manufacturer's published literature.
8. Renewable Seat: Design seat of valve with removable disc, and assemble valve so disc can be replaced when worn,
9. Extended Stem: Increase stem length by 2" minimum, to accommodate insulation applied over valve.
10. Check Valve: Check valve designed with hinged disc which seals against seat machined in bridge wall of valve body and manufactured for automatic closure by flow reversal.

E. GATE VALVES:

1. Acceptable Manufacturers: Subject to compliance with requirements, provide valves of one of the following:
   a. Conbraco Industries, Inc.
   b. Jamesbury Corp.
   c. Milwaukee Valve Co., Inc.
   d. NIBCO, Inc.
2. Comply with the following standards:
   a. Cast Iron Valves: MSS SP-70
   b. Bronze Valves: MSS SP-80
3. For Domestic Water Service: Valves shall be rated 200 PSI non-shock CWP, non-rising stem, screw-in bonnet, solid wedge. Body, bonnet,external stuffing box and wedge are to be of lead-free* dezincification-resistant material. Stems shall be of dezincification-resistant

silicon bronze ASTM B 371 or low-zinc alloy B 99, non-asbestos packing and malleable or ductile iron hand wheel. Valve ends may be threaded or solder-type. Valves shall NSF/ANSI-61-8 Commercial Hot 180°F (including Annex F and G) and NSF/ANSI-372.

a. Basis of Design: NIBCO ® T113-LF (threaded); S113-LF (solder)

b. Basis of Design: Milwaukee UP105 (threaded) ; UP115 (solder)

4. For Domestic Water Service Entrance piping:

a. Flanged Ends 2-1/2" and Larger: Class 125, flanged, bronze body, bolted bonnet, rising stem, OS&Y, solid wedge.

F. DRAIN VALVES:

1. For Low Pressure Drainage Service:
2. Acceptable Manufacturers: Subject to compliance with requirements, provide valves of one of the following:

a. Conbraco Industries, Inc.

b. Jamesbury Corp.

c. NIBCO, Inc.

3. Threaded Ends 2" and Smaller: Class 125, bronze body, screwed bonnet, rising stem, composition disc, 3/4" hose outlet connection,
4. Soldered Ends 2" and Smaller Class 125, bronze body, screwed bonnet, rising stem, composition disc, 3/4" hose outlet connection,

G. BALL VALVES:

1. Acceptable Manufacturers: Subject to compliance with requirements, provide valves of one of the following:

a. Conbraco Industries, Inc.

b. Milwaukee Valve Co., Inc.

c. NIBCO, Inc.

2. General: Valves shall be rated 600 PSI non-shock CWP, valve ends shall have full depth ANSI threads or extended solder connections.
3. Comply with the following standards: MSS SP-110
4. Domestic Water: Valves shall be rated 600 PSI non-shock CWP and will have 2-pc. Lead-free bronze body and end piece, Stainless steel trim, stem and ball, PTFE seats, full port, separate pack nut with adjustable stem packing, anti-blowout stems and have the capability of accepting extended operating handles. Valve ends shall have full depth ANSI threads or extended solder connections. Valves shall be 3rd party certified to NSF/ANSI-61-8Commercial Hot 180°F (including Annex F and G) and NSF/ANSI-372. Valves for use in insulated piping systems shall be equipped with 2" extended handles of non-thermal conductive material. A protective sleeve shall allow operation of the valve without disturbing the installation and providing a vapor seal. Product shall be NIBCO NIB-SEAL or approved equal.

a. Threaded Valves:

1) Basis of Design: NIBCO T585HP-66-LF (1/4" to 4")

2) Basis of Design: Milwaukee UPBA400S (1/4" to 2")

b. Soldered Valves:Basis of Design (threaded ends): NIBCO T585HP-66-LF (1/4" to 4")

1) Basis of Design: NIBCO S585HP-66-LF (1/4" to 4")

2) Basis of Design: Milwaukee UPBA450S (3/8" to 2")

c. Press Fit Vavles:

1) Basis of Design: NIBCO PC-585HP-66-LF (1/4" to 4")
2) Basis of Design: Milwaukee UPBA400S P2 (1/2" to 2")

5. Natural Gas Service (Line Service Valve - up to 5psi. 1/2"-2"): Threaded Ends 2" and Smaller: 600#WOG, ASME B16.33, ASME B16.44-2G(2psig service), ASME B16.44-5G(5psig service), Full port, forged brass/bronze 2 piece body, hard chrome plated forged brass/bronze ball, blow-out proof stem.
   a. Basis of Design: NIBCO ® T-FP-600A-LF (threaded)
   b. Basis of Design: Milwaukee BA475B (threaded)
6. Natural Gas Service(Appliance Shutoff - up to 5psi, 1/2"-1"): Threaded Ends 1" and Smaller: 600# W.O.G., Full port, ANS Z21.15/CSA 9.1 listed for 1/2psig indoor appliance connections, lever handle, forged brass/bronze body, hard chrome plated forged brass/bronze ball, blow-out proof stem.
   a. Basis of Design : NIBCO GB Series
   b. Basis of Design: Milwaukee BA475B

H. ADJUSTABLE THERMAL BALANCING VALVE

1. Acceptable Manufacturers: Subject to compliance with requirements, provide valves of one of the following:
   a. Caleffi.
2. Adjustable Thermal Balancing Valve for domestic hot water recirculation circuits. Internal thermostatic balancing cartridge automatically modulates flow to ensure constant temperature which is adjustable from 95 degrees F to 140 degrees F. Sizes ½" and ¾" with NPT female connections. Provided with DZR low-lead brass valve, stainless steel and copper adjustable thermostatic cartridge, EPDM hydraulic seals, 302 stainless steel springs, ABS adjustment knob with temperature adjustment scale and tamper-proof adjustment locking screw, and 10 mm temperature gauge/probe dry-well port. Provide with optional check valve and pre-formed insulation shell. Provide with optional (model dependent) outlet temperature gauge, 30 degrees F to 180 degrees F scale, 1½ inch diameter.
   a. Maximum working pressure: 230 psi
   b. Maximum differential pressure: 15 psi
   c. Maximum inlet temperature: 195 degrees F.
   d. Flow rating: 2.1 Cv (1.8 Kv) maximum, 0.23 Cv (0.2 Kv) minimum, 0.52 Cv (0.45 Kv) design.
   e. Suitable fluid: water.
   f. Meets requirements of ANSI/NSF 372-2011. Certified to low-lead laws and listed by ICC-ES, file PMG-1360, for use in accordance with U.S. and Canadian plumbing codes.
   g. Basis of Design:
      1) Caleffi Code series 1161#0A, for domestic hot water recirculation circuits.
         (a) with inlet check valve 1161#0AC
         (b) with temperature gauge 1161#1A (1161#1AC - w/check valve)
      2) Caleffi Code series 1162#0A, for domestic hot water recirculation circuits with thermostatic by-pass cartridge for thermal disinfection function. Complete with outlet temperature gauge. Disinfection temperature 160 degrees F (70 degrees C), closing temperature 170 degrees F (75 degrees C) and disinfection flow rating 1.2 Cv (1.0 Kv).

(a) with inlet check valve 1162#0AC
(b) with temperature gauge 1162#1A (1161#1AC - w/check valve)

3) Caleffi Code series 1163#0A, for domestic hot water recirculation circuits with by-pass valve for thermal disinfection function with optional code 656 series thermo-electric actuator. Complete with outlet temperature gauge. Disinfection temperature 160 degrees F (70 degrees C), closing temperature 170 degrees F (75 degrees C) and disinfection flow rating 1.2 Cv (1.0 Kv).
(a) with inlet check valve 1163#0AC
(b) with temperature gauge 1163#1A (1161#1AC - w/check valve)

I. MANUAL BALANCING VALVES

1. Acceptable Manufacturers: Subject to compliance with requirements, provide valves of one of the following:
   a. Conbraco Industries, Inc.
   b. Milwaukee Valve Co., Inc.
   c. NIBCO, Inc.
2. Domestic Hot Water Service: Return branch balancing valves ½ " to 2" shall be Globe Style, . Valve shall have integral metering/test ports for flow balancing and flow measurement. Test ports shall have internal check valve and be equipped with caps. Valves shall be manufactured from lead free dezincification resistant brass or bronze rated 240 psi at 250 F. All balancing valves shall have position indication readout and built in memory stop for repeatable regulation and control.
   a. Basis of Design: NIBCO ® Series 1810-LF

J. CIRCUIT SETTER BALANCING VALVES

1. Acceptable Manufacturers: Subject to compliance with requirements, provide valves of one of the following:
   a. Bell & Gosset
2. Domestic Hot Water Service: Circuit Balancing Valves ½ " to 2" shall be Lead Free ball valve style. Valve shall have integral metering/test ports for flow balancing and flow measurement and be able to be pre-set to appropriate flow. Test ports shall have internal check valve and be equipped with caps. Valves shall be manufactured from dezincification resistant brass or bronze rated 240 psi at 250 F. All circuit balancing valves shall have calibrated nameplates with position indication readout and built in memory stop for repeatable regulation and control and designed for positive shutoff.
   a. Basis of Design: Bell & Gosset ® CB - LF Series

K. BUTTERFLY VALVES:

1. General: Comply with MSS SP-67. Where butterfly valves are used as shutoffs for terminal or equipment removal or repair, select lug type valves. Select wafer type valves for other applications. Grooved end butterfly valves shall be used in grooved joint piping systems. Provide gear operation on butterfly valves 8" and larger, Provide valve bodies with 2" necks where insulation is 2" thick or greater.

L. SWING CHECK VALVES:

1. Acceptable Manufacturers: Subject to compliance with requirements, provide valves of one of the following:
   a. Conbraco Industries, Inc.
   b. Milwaukee Valve Co., Inc.
   c. NIBCO, Inc.
2. Comply with MSS SP-71 and MSS SP-SO for design, workmanship, material and testing.
3. For Domestic Water Service: Valves shall be Y-pattern swing-type rated 200 PSI non-shock CWP. Body, bonnet, and disc hanger are to be of lead-free dezincification-resistant material and PTFE seat disc. Valve ends may be threaded or solder-type. Valves shall be 3rd party certified to NSF/ANSI-61-8 Commercial Hot 180°F (including Annex F and G) and NSF/ANSI-372.
   a. Threaded Valve:
      1) Basis of Design: NIBCO ® T413-Y-LF S413-Y-LF (solder)
      2) Basis of Design: Milwaukee UP509
   b. Solder Valve:
      1) Basis of Design: NIBCO ® S413-Y-LF
      2) Basis of Design: Milwaukee UP1509

2.18 LOW PRESSURE Y-TYPE STRAINERS:

A. Manufacturer: Subject to compliance with requirements, provide low pressure Y-Type strainers of one of the following:

1. Armstrong Machine Works.
2. Hoffman Specialty, ITT Fluid Handling Div.
3. Metraflex Co.
4. Crane Co., Valve Div.
5. Milwaukee Valve Co., Inc.
6. NIBCO, Inc-

B. General: Comply with FCI 73-1. Provide strainers full line size of connecting piping, with ends matching piping system materials. Select strainers for 125 psi working pressure, with Type 304 stainless steel screens, with 3/64" perforations @ 233 per sq. in.

C. All valves and specialties within the domestic potable water piping shall meet the Lead Free requirements of the Safe Drinking Water Act (Sec. 1417) amended 1-4-2011 (weighted average lead content = 0.25%) and other equivalent state regulations

1. Threaded Ends: 2" and Smaller: Lead Free Bronze body rated for 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen, with centered blowdown fitted with threaded ball valve and pipe plug.
2. Threaded Ends: Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen, with centered blowdown fitted with threaded ball valve and pipe plug.
3. Flanged Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with threaded ball valve and pipe plug.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION

A. PIPING INSTALLATION:

1. General: Install pipe, tube and fittings in accordance with recognized industry practices which will achieve permanently leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with a minimum of joints and couplings, but with adequate and accessible unions for disassembly and maintenance/ replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connection, within 1/16" misalignment tolerance.
2. Install all piping in accordance with International Plumbing Code (IPC), International Fuel Gas Code(IFGC), and ANSI B31 Code for Pressure Piping requirements as applicable to each system.
3. Provide corrosion inhibiting epoxy paint and primer on all exterior gas piping. Clean and prep piping surface prior to application. Verify color to be used with architect prior to application.
4. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in the shortest route which does not obstruct usable space or block access for servicing the building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanently enclosed elements of the building; limit clearance to 0.5" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1.0" clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal piping from view by locating in column enclosures, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.
5. Electrical Equipment Spaces: Do not run piping through transformer vaults and other electrical equipment spaces and enclosures including elevator machine rooms.
6. Piping System Joints: Provide joints of the type indicated in each piping system.
7. Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Read threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound/tape on male threads at each joint and tighten joint to leave not more than 3 threads exposed.
8. Solder copper tube and fittings joints in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in a manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.
9. Weld pipe joints in accordance with ANSI B31.

10. Flanged Joints: Match flanged within piping systems, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.
11. Insulating Unions: Comply with manufacturer's instructions for installing unions. Install unions in a manner which will prevent galvanic action and stop corrosion when joining ferrous and non-ferrous piping.
12. Grooved Joints: Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to grooved. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and installation of grooved joint products. The manufacturer's representative shall periodically visit the job site and review and installation. Contractor shall remove and replace any joints deemed improperly installed.
13. Unless noted otherwise on the Plumbing drawings all Sanitary/Waste, Kitchen Sanitary/Kitchen Waste, Rainwater, Emergency Rainwater, and Storm piping shall be installed at a minimum continuous 2% slope (1/4" per foot).
14. Unless noted otherwise on the Plumbing drawings all Vent, Condensate Drainage, and Radon Remediation piping shall be installed at a minimum continuous 1% slope (1/8" per foot).
15. Provide penetration firestopping for all work of Div. 22 in accordance with Div. 07 specifications.

B. PIPING INSPECTION:

1. General: Clean exterior surfaces of installed piping systems of superfluous materials and prepare for application of specified coatings if any. Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.
2. Disinfect water service piping in accordance with IPC or as required otherwise by local AHJ. Perform bacteriological and chemical contaminant testing in accordance with IPC and submit test results to Engineer and local AHJ.

C. PIPING TESTS:

1. General: Provide temporary equipment for testing, including pumps and gages. Test piping system before insulation is installed wherever feasible and remove control devices before testing.
2. Test each natural section of each piping system independently, but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for the indicated pressure and time.
3. Test piping installations and backflow preventers in accordance with IPC Section 312. Coordinate testing with local AHJ.
4. Repair piping systems sections which fail the required piping tests by disassembly and reinstallation, using new materials to the extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics or other temporary repair methods.

D. PIPING DISINFECTION

1. Disinfect potable water supply piping in accordance with IPC Section 610 or as required otherwise by local AHJ. Perform bacteriological and chemical contaminant testing in accordance with IPC and submit test results to Engineer and local AHJ.

E. HANGERS AND SUPPORTS:

1. Proceed with the installation of hangers, supports and anchors only after the required building structural work has been completed in areas where work is to be installed. Correct inadequacies including (but not limited to) the proper placement of inserts, anchors and other building attachments.

F. BUILDING ATTACHMENTS INSTALLATION:

1. Install building attachments at the required locations within concrete or onto structural steel for proper piping support. Space attachments within the maximum piping span length indicated in MSS SP-69 and IPC. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through the openings at the top of inserts. Prior to placing concrete, install nut in insert and screw threaded rod thru nut until rod is firmly against top of the insert body.

G. HANGERS AND SUPPORTS INSTALLATION:

1. General: Install hangers, supports, clamps and attachments to support piping properly from the building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with the maximum spacing complying with MSS SP-69. Where piping of various sizes is to be supported together with trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire of perforated metal to support piping, and do not support piping from other piping.
2. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of the same type and style as installed for adjacent similar piping.
3. Provide additional steel as required to span structural members for intermediate support of piping required between structural framing members. ALL piping shall be supported from structural framing members only. Coordinate all work with other trades.
    a. Do not fasten or anchor work to concrete floor deck except where individually approved by Structural Engineer and Architect.
    b. Do not fasten or anchor any work directly to metal roof deck.
    c. Prevent electrolysis in support of copper tubing by the use of hangers and supports which are copper plated, or by other recognized industry methods.
    d. Provisions for movement:
        1) Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate the action of expansion joints, expansion loops, expansion bends and similar units.
        2) Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

3) Pipe Slopes: Install hangers and supports to provide the indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B3I are not exceeded.

e. Insulated Piping: Comply with the following installation requirements:

1) Saddles/Shields: Where low compressive strength insulation of vapor barriers are indicated on piping, install coated protective shields at all hanger locations.

H. PIPE GUIDE INSTALLATION:

1. Install pipe guides complying with the manufacturer's published product literature. Where not otherwise indicated, install pipe guides on each side of expansion loops.

I. PIPING ANCHORS INSTALLATION:

1. Install anchors at the proper location to prevent stresses from exceeding those permitted by ANSI B3I, and to prevent the transfer of loading and stresses to connection equipment.
   a. Fabricate and install anchor by welding steel shapes, plates and bars to the piping and to the structure. Comply with ANSI B3I and with AWS standards.
   b. Anchor Spacings: Where not otherwise indicated, install anchors at the ends of principal pipe runs, at intermediate points in pipe runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

J. ADJUSTMENT OF HANGERS AND SUPPORTS:

1. Adjust hangers and supports and place grout as required under floor mounted supports to bring piping to proper levels and elevations.

K. VALVE INSTALLATION:

1. General: Except as otherwise indicated, comply with the following requirements:
   a. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.
   b. Install valves with stems pointed up, in the vertical position, where possible, but in no case with stems pointed downward from a horizontal plane unless unavoidable. Install valve drains with hose-end adapter for each valve that must be installed with stem below horizontal plane.
   c. Insulation: Where insulation is indicated, install extended stem valves, arranged in the proper manner co receive insulation.
   d. Applications Subject to Shock; Install valves with bodies of metal other than cast iron where thermal or mechanical shock is indicated or can be expected to occur.
   e. Applications Subject to Corrosion: Do not install bronze valves and valve components in direct contact with steel, unless the bronze and steel are separated by a dielectric insulator. Install bronze valves in steam and condensate service and in other services where corrosion is indicated or can be expected to occur.

f. OS&Y Valve Stem: Select and install gate valves with outside screw and yoke stems, except provide inside screw non-rising stem valves where headroom prevents full opening of OS&Y valves.

g. Non-Metallic Disc: Limit the selection and installation of valves with non-metallic discs to locations indicated and where foreign material in the piping system can be expected to prevent tight shut off of metal seated valves.

h. Renewable Seats: Select and install valves with renewable seats, except where frequent usage of the valves is indicated.

L. STRAINER INSTALLATION

1. Y-Type Strainers: Install Y-type strainers full size of pipeline, in accordance with manufacturer's installation instructions. Install pipe nipple and shutoff valve in strainer blow down connection, full size of connection, except for strainers 2" and smaller installed ahead of control valves feeding individual terminals. Where indicated, provide drain line from shutoff valve to plumbing drain, full size of blow down connection.
2. Locate Y-type strainers in supply line ahead of the following equipment, and elsewhere as indicated, if integral strainer is not included in equipment:
   a. Pumps.
   b. Temperature control valves.
   c. Pressure reducing valves.
   d. Temperature or pressure regulating valves.

M. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

N. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

O. Install piping to maintain headroom, conserve space, and not interfere with use of space.

P. Group piping whenever practical at common elevations.

Q. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 22 0516.

R. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 0719.

S. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 3100.

T. Establish elevations of buried piping outside the building to ensure not less than four ft of cover.

U. Install vent piping penetrating roofed areas to maintain integrity of roof assembly. Coordinate all requirements with roof installer. Install vent piping penetrations in existing roof assemblies in accordance with all requirements of the roof manufacturer to maintain existing roof warranty.

V. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

W. Provide support for utility meters in accordance with requirements of utility companies.

X. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 9000.

Y. Install bell and spigot pipe with bell end upstream.

Z. Install valves with stems upright or horizontal, not inverted.

AA. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.

BB. Install water piping to ASME B31.9 and IPC requirements.

CC. PVC Pipe: Make solvent-welded joints in accordance with ASTM D 2855.

DD. Sleeve pipes passing through partitions, walls and floors.

3.4 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

D. Provide spring loaded check valves on discharge of water pumps.

E. Provide plug valves in natural gas systems for shut-off service in piping systems larger than 2".

F. Provide ball valves with lever handles in natural gas systems for equipment shutoff valves.

G. Provide flow controls in water recirculating systems where indicated. Balance recirculation system to achieve timely delivery of hot water to all plumbing fixtures in accordance with IECC and local Health Department requirements.

3.5 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect water distribution system in accordance with IPC, AWWA, or other method as directed by Local A.H.J. Where sanitizing procedure is not specified by local codes follow the procedure below.

1. Prior to starting work, verify system is complete, flushed and clean.
2. Ensure Ph of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
3. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.
4. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
5. Maintain disinfectant in system for 24 hours.
6. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
7. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
8. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.6 SERVICE CONNECTIONS

A. Provide new sanitary and storm sewer connections as noted on plans. Before commencing any work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and minimum cover as required by AHJ.

B. Provide new domestic water service complete with approved backflow preventer and pressure reducing valves. Provide water service entrance piping installations in accordance with all requirements of local municipal Water Authority.

C. Provide connection to new gas service from meter outlet and extend to equipment as noted on plans. P.C. shall provide 6"thick concrete meter base pad, required size shall be verified with gas utility company. P.C. shall arrange for and coordinate all details of gas service connection with G.C. and local gas utility company including verification of delivery pressure and total connected load of all submitted equipment. P.C. shall notify design team if delivery pressure is different than pressures documented on design drawings prior to installation of regulators and final service connection. P.C. shall verify all specific requirements of the gas utility and provide all requirements in accordance with utility requirements including but not limited to: line pressure gas regulator requirements, overpressure protection, testing, and identification of piping and specialties.

END OF SECTION 22.1005

SECTION 22.1006 - PLUMBING PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Automatic Clothes Washing Machine Connection
B. Backflow preventers.
C. Backwater Valves
D. Cleanouts.
E. Floor drains.
F. Floor Sinks
G. Fresh air inlet
H. Gas Pressure Regulators
I. Hose bibbs.
J. Hydrants.
K. Cold Water Hose Reels.
L. Pressure reducing valves
M. Roof Drains
N. Shock Absorbers/Water hammer arrestors.
O. Thermostatic mixing valves.
P. Trench Drains
Q. Washdown Connection Box
R. Water Outlet Connection Box

1.2 RELATED REQUIREMENTS

A. Section 22 0100 - General Provisions
B. Section 22 1005 - Plumbing Piping.
C. Section 22 3000 - Plumbing Equipment.
D. Section 22 4000 - Plumbing Fixtures.

1.3 REFERENCE STANDARDS

A. ASME A112.6.3 - Floor and Trench Drains; The American Society of Mechanical Engineers; 2001 (R2007).
B. ASME A112.6.4 - Roof, Deck, and Balcony Drains; The American Society of Mechanical Engineers; 2003.

C. ASSE 1011 - Hose Connection Vacuum Breakers; American Society of Sanitary Engineering; 2004 (ANSI/ASSE 1011).

D. ASSE 1012 - Backflow Preventer with Intermediate Atmospheric Vent; American Society of Sanitary Engineering; 2009 (ANSI/ASSE 1012).

E. ASSE 1013 - Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers; 2011

F. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance; 2011

G. IBC - ICC - International Building Code

H. IPC - ICC - International Plumbing Code

I. IFGC - ICC - International Fuel Gas Code

J. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015)

K. NSF 372 - Drinking Water System Components - Lead Content; 2011

L. PDI-WH 201 - Water Hammer Arresters; Plumbing and Drainage Institute; 2006.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data for all Piping Specialty specified herein and on the Plumbing Drawings. Clearly indicate exact models/model number, options, and accessories to be provided for each product. Submittals shall clearly indicate applications where the submitted product is to be used. Manufacturer data shall indicate, material of construction, applicable standards and listings, design pressure and ratings, etc.

C. Maintenance Data: Submit maintenance data and spare parts lists for each Piping Specialty. Include this data in Maintenance Manual.

D. Review of submittals which do not clearly indicate the information noted above may be delayed or Rejected due to lack of clarity or information. Generic catalog sheets with no indication of options, accessories, or model to be provided will be Rejected without further review.

E. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.

F. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, water hammer arrestors .

G. Operation Data: Indicate frequency of treatment required for interceptors.

H. Maintenance Data: Include installation instructions, routine maintenance instructions, spare parts lists, exploded assembly views.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

1.7 EXTRA MATERIALS

A. See Section 01 6000 - Product Requirements, for additional provisions.

B. Supply the following for Owner's use in maintenance of project:

1. Two loose keys for outside hose bibbs.
2. Two hose end vacuum breakers for hose bibbs.
3. One service kit for each type/style and size of backflow preventer.
4. One service kit for each type/style and size of pressure reducing valve.
5. Two service kits for each type/style and size of hydrant/washdown box, etc.
6. One replacement valve for every 10 of each type/style and size of point of use Thermostatic mixing valve
7. One service kit for each type/style and size of Master Mixing Thermostatic mixing valve
8. One replacement water hammer arrestor for every 10 of each type/style and size of water hammer arrestor
9. One service kit for each backwater valve.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Specialties installed within Potable Water Supply Systems: Provide "Lead Free" products that comply with NSF 61 and NSF 372 for maximum lead content.

2.2 AUTOMATIC CLOTHES WASHING MACHINE CONNECTION

A. Box Manufacturers:

1. Guy Gray Corporation:
2. IPS Corporation/Water-Tite: www.ipscorp.com.
3. Oatey: www.oatey.com.
4. Substitutions: Other acceptable manufacturers offering equivalent products as approved by Architect/Engineer/Owner. Refer to Division 01 specifications for additional information.

B. (AWC-1) Washing Machine Connection Box w/Water Hammer Arrestors and Preformed Drain Outlet

1. PVC preformed rough-in box with brass valves with single lever handle and water hammer arrestors, socket for 2 inch waste, slip in finishing cover.
2. Basis of Design: IPS Watertite 85708

2.3 BACKFLOW PREVENTERS

A. Manufacturers:

1. Ames Co. Fluid Control Systems: www.amesfirewater.com
2. Conbraco Industries: www.conbraco.com.
3. Watts Regulator Company: www.wattsregulator.com.
4. Wilkin/Zurn Industries, Inc: www.zurn.com.

5. Substitutions: Other acceptable manufacturers offering equivalent products as approved by Architect/Engineer/Owner. Refer to Division 01 specifications for additional information.

B. Service Entrance - Double Check Assembly Backflow Preventer (2½"-10")

1. ASSE 1015, USC-Manual for Cross-Connection Control 8th Edition, UL Listed; FDA Epoxy coated cast iron body with stainless steel seats and stainless steel springs; two independently operating, spring loaded check valves; assembled with two OS&Y gate valves, inlet strainer, and four test cocks.
   a. Watts Model LF709-OSY-S or approved equal

C. Service Entrance - Reduced Pressure Zone Backflow Preventers (2-1/2"-10"):

1. ASSE 1013; FDA epoxy coated cast iron body with stainless steel internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two OS&Y gate valves, strainer, air gap fitting, and four test cocks.
   a. Watts Model LF909- OSY/S-FDA (2-1/2"-10") w/series 909AG air gap fitting or approved equal.

D. Reduced Pressure Zone Backflow Preventers (3/4"-2"): Boiler makeup water, mechanical equipment, and irrigation water connections, etc.

1. ASSE 1013; Lead free, cast copper/bronze body with bronze internal parts and stainless steel check springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two quarter turn ball valves, strainer, air gap fitting, and four test cocks.
   a. Watts Model LF909-QT-S (3/4"-1") w/series 909AG air gap fitting or approved equal
   b. Watts Model LF909-M1-QT-S (1¼"-2") w/series 909AG air gap fitting or approved equal

E. Double Check Backflow Preventers (1/4"-2"):

1. ASSE 1015; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; assembled with two quarter turn ball valves, strainer, and four test cocks.
   a. Watts Model S-QT-LF007 or approved equal

F. Beverage Dispenser Connection Backflow Preventers (1/4"-3/8"):

1. ASSE 1022; NSF; Dual Check w/atmospheric vent, 316SS body and adapters; two independently operating check valves w/atmospheric vent, strainer.
   a. Watts Model SD-3 w/strainer or approved equal
2. Pipe atmospheric vent to visible air gap discharge
3. All downstream piping to beverage dispenser shall be 316SS (no copper permitted)

G. Ice Machine Connection Backflow Preventers (1/4"-1")

1. Dual Check , straight line, poppet-type construction to minimize pressure drop, all copper construction, double unions for installation, chloramine resistant materials of construction.
   a. Watts Model LF7, or approved equal.

H. Refrigerator mounted Ice Maker/Water Dispenser Machine Connection Backflow Preventers (1/4"-1/2")

1. Dual Check , straight line, poppet-type construction to minimize pressure drop, all copper construction, double unions for installation, chloramine resistant materials of construction.
   a. Watts Model LF7, or approved equal.

2.4 BACKWATER VALVES

A. Manufacturers:

1. RectorSeal; www.rectorseal.com.
2. Mainline; www.backwatervalve.com
3. Substitutions: Other acceptable manufacturers offering equivalent products as approved by Architect/Engineer/Owner. Refer to Division 01 specifications for additional information.

B. (BWV) Backwater Valve:

1. PVC body, extension collar, PVC flapper replaceable from grade
2. Extension collar length as required to extend to grade
3. Inspection cover and collar. provide manufacturers inspection lid/collar
4. H20 rated heavy duty cast iron access cover and frame in concrete collar. Refer to details.
5. Basis of Design: Rectorseal Clean Check backwater valve with Neenah Foundry Model 1815 cover.

2.5 CLEANOUTS

A. Manufacturers:

1. Jay R. Smith Manufacturing Company; www.jayrsmith.com.
2. Josam Company: www.josam.com.
3. Zurn Industries, Inc.: www.zurn.com.
4. Mifab Drainage Products: www.zurn.com.
5. Substitutions: Other acceptable manufacturers offering equivalent products as approved by Architect/Engineer/Owner. Refer to Division 01 specifications for additional information.

B. (CTG) Cleanouts to Grade (exterior areas):

1. Round, flanged cast iron housing and heavy duty scoriated cast iron cover.
2. Refer to plans for locations and details of installation.
3. Basis of design J.R. Smith Model 4250/4261 series with top finish as required by Architect:
   a. Outlet Connection style/type to be determined by contractor.

C. (FCO) Cleanouts at Interior Finished Floor Areas:

1. Lacquered cast iron body with flashing flange, threaded ABS plug assembly, and round Nickel Bronze cover. Cover shall be scoriated in service areas, round recessed cover to accept floor finish in terrazzo and similar floor areas, and carpet marker type for units installed in carpeted areas (refer to Architectural floor finish plans for additional information).
2. Basis of design: J.R. Smith Model 4020/4031/4025 series with cover style/finish as required by final floor finish (Outlet connection type as determined by P.C)
3. Basis of design J.R. Smith Model 4100 series (Heavy Duty Traffic Areas)(Outlet connection type as determined by P.C)

D. (FCO) Cleanouts Boiler Room/Mechanical Room Floor Areas:

1. Lacquered cast iron body with anchor flange, threaded ABS plug assembly, and round Nickel Bronze cover. Cover shall be scoriated in service areas.

2. Basis of design: J.R. Smith Model 4100/4111/4105 series (Outlet connection type as determined by P.C)

E. (FCO) Cleanouts at Interior Finished Floor Area (Resilient Sheet Flooring)

1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded ABS plug assembly, and round gasketed cover with surface membrane clamp . (See documents for additional information).
2. Basis of Design: J.R. Smith Model: 4023

F. (WCO) Cleanouts at Interior Finished Wall Areas:

1. Provide Sanitary-T and extension to finish wall construction with Cleanout ferrule, threaded plug and cover. Refer to Plumbing Details for additional information.
2. Cover
   a. Finished Tile walls - Provide w/stainless steel cover
   b. Finished painted walls - Provide with prime coated paintable steel cover

G. Cleanouts at Interior Unfinished Accessible Areas: Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.6 FLOOR DRAINS

A. Manufacturers:

1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
2. Zurn Industries, Inc: www.zurn.com.
3. Josam Company: www.josam.com.
4. Mifab Drainage Products: www.zurn.com.
5. Substitutions: Other acceptable manufacturers offering equivalent products as approved by Architect/Engineer/Owner. Refer to Division 01 specifications for additional information.

B. (CD-1) Floor Mounted Condensate Drain:

1. ASME A112.6.3; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer with extended anti-splash rim (mount with strainer assembly rim above finished floor elevation to prevent grey water being introduced into condensate drain system.) Provide unit with backwater valve accessory.
   a. Deep Seal P-trap
2. Refer to drawings for locations and system sizes.
3. Basis of Design:
   a. J.R. Smith: Model 2005-F37NB-BFV

C. (FD-1) Floor Drain - General area floor drains, toilet rooms, showers, etc.:

1. ASME A112.6.3; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, twist-to-floor adjustable nickel bronze strainer.
   a. Deep seal P-trap
   b. Pro-Set "trap-guard" sewer gas prevention system.
   c. Sediment bucket option in all shower floor drain
2. Refer to drawings for locations and system sizes.
3. Basis of Design:

a. J.R. Smith: Model 2005-NB with 6" round strainer, drain outlet size shall be as indicated on drawings.
b. Zurn: Model ZN415B with 6" round strainer, drain outlet size shall be as indicated on drawings.

D. (FD-2) Floor Drain - Boiler Room Floor Drain: Shallow Sump

1. ASME A112.6.3; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and twist-to-floor adjustable 8" round ductile iron "safe-set" sediment bucket and grate.
   a. Deep Seal P-trap
   b. Pro-Set "trap-guard" sewer gas prevention system
2. Refer to drawings for locations and system sizes.
3. Basis of Design:
   a. J.R. Smith: Model 2350-MBG.

E. (FD-2A) Floor Drain - Boiler Room Equipment Drain - Deep Sump: (Boilers, Water Softener, Blowdown)

1. ASME A112.6.3; Deep body, lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and adjustable ductile iron "safe-set" sediment bucket and grate.
   a. Provide Pro-Set "trap-guard" sewer gas prevention system in all floor drains.
2. Refer to drawings for locations and system sizes.
3. Basis of Design:
   a. J.R. Smith: Model 2240 Series.

2.7 FRESH AIR INLET

A. Manufacturers:

1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
2. Josam Company: www.josam.com.
3. Mifab Drainage Products: www.zurn.com.
4. Zurn Industries, Inc: www.zurn.com.
5. Substitutions: Other acceptable manufacturers offering equivalent products as approved by Architect/Engineer/Owner. Refer to Division 01 specifications for additional information.

B. (FAI) Fresh Air Inlet

1. Round perforated pipe cover with Polished Nickel Bronze finish and vandal proof screws, pipe clamp with set screw
2. Basis of Design:
   a. J.R. Smith: Model 9005.

2.8 GAS PRESSURE REGULATORS

A. Acceptable Manufacturer:

1. Fisher Controls - Proconex; Proconexdirect.com
2. Pietro Fiorentini - Accardi Companies; accardicompanies.com

B. Line Pressure Regulators General requirements

1. Type: Single stage, fast acting, lockup type, suitable for natural gas service, steel jacket, and corrosion resistant components.
2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. SealPlug: Ultraviolet-stabilized,mineral-fillednylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream during lockup no flow condition. Token relief valve to limit downstream pressure during no flow condition
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless steel screen in opening if exterior installation not connected to vent piping.
12. Approvals: Comply with ANSI 221.80. Comply with requirements of Gas Utility Company
13. Design Basis: Refer to Regulator Schedule on Plumbing drawings for additional requirements and design parameters.

2.9 HOSE BIBBS

A. Manufacturers:

1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
2. Josam Company: www.josam.com.
3. Woodford
4. Watts Regulator Company: www.wattsregulator.com.
5. Zurn Industries, Inc: www.zurn.com.
6. Mifab Drainage Products
7. Substitutions: Other acceptable manufacturers offering equivalent products as approved by Architect/Engineer/Owner. Refer to Division 01 specifications for additional information.

B. (HB-1) Interior Hose Bibbs:

1. Chrome Plated Bronze or brass with integral wall flange, replaceable hexagonal disc, hose thread spout, interchangeable handwheel and loose key operation, dual check with atomospheric vent in conformance with ASSE 1052
2. Basis of Design: Woodford Model 26P

2.10 NON FREEZE WALL HYDRANT

A. Manufacturers:

1. Josam Company: www.josam.com.
2. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
3. Zurn Industries, Inc: www.zurn.com.
4. Substitutions: Other acceptable manufacturers offering equivalent products as approved by Architect/Engineer/Owner. Refer to Division 01 specifications for additional information.

B. (NFWH-1) Enclosed Non-Freeze Wall Hydrants (Cold Water):

1. ASSE 1019-B, ASSE 1052, ASSE 1053; freeze resistant, box type, self-draining type with bronze quarter turn Non-freeze automatic draining hydrant with Stainless Steel face, adjustable wall

clamp, hose connection, Integral vacuum Breaker and Dual check valve, "T" hnadle key, wheel handle and Stainless Steel Box with Full 180 deg. cover opening w/cylinder lock.

2. Installation Height: Approx.. 24" above grade (totally within same color masonry) Coordinate exact locations and elevations with architect prior to rough-in.
    a. Basis of Design: Jay R. Smith Manufacturing Company; Model 5519-WC-CL (barrel shall extend minimum 6" into heated side of exterior wall, verify wall thicknessand required barrel length in field)

2.11 COLD WATER HOSE REELS

A. Manufacturers:

1. Graco: www.graco.com
2. Substitutions: Other acceptable manufacturers offering equivalent products as approved by Architect/Engineer/Owner. Refer to Division 01 specifications for additional information.

B. (HR-1) HOSE REEL AND ACCESSORIES – WATER

1. Ceiling or wall mounted hose reel: consists of a spring driven retractable hose reel with maximum 300 psi pressure, complete with 50 foot of 3/4" pressure hose and mounting bracket.
    a. Provide all required support steel for mounting. Coordinate in field with building structural steel supplier.
    b. Hose reel shall be GRACO XD30 Series Model HSLD5B or approved equal.
2. Accessories
    a. Connecting hose and swivel inlet fitting: GRACO Model 24E248
    b. Fluid hose label: GRACO (WATER)
3. Reel Mounting Hardware: - Reel mounting bracket
    a. GRACO Model: 204741 I beam channel mounting bracket

2.12 PRESSURE REDUCING VALVES

A. Manufacturers:

1. Watts
2. Wilkins
3. Zurn
4. Substitutions: Other acceptable manufacturers offering equivalent products as approved by Architect/Engineer/Owner. Refer to Division 01 specifications for additional information.

B. (PRV-1) Water Pressure Reducing Valve shall be installed on the water service pipe near entrance to the building where supply main pressure exceeds 60 psi.

1. Enlarged diaphragm, spring cage and seat orfice, flanged inlet and flange outlet with strainer
2. Iron Body constrcuiont
3. Stainless Steel Piston
4. Basis of Design:
    a. Watts LFN223FS

C. (PRV-2) Water Pressure Reducing Valve

1. Sealed spring cage and stainless steel corrosion resistant adjusting & cage screws
2. Union inlet conneciton

3. Integral stainless steel strainer
4. Replaceable seat module
5. Lead free cas copper silicon alloy construction
6. Basis of Design:
    a. Watts LF25AUB-Z3

2.13 ROOF DRAINS AND ACCESSORIES

A. Manufacturers (for all drainage products):

1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
2. Josam Company: www.josam.com.
3. Mifab Drainage Products: www.zurn.com.
4. Zurn Industries, Inc: www.zurn.com.
5. Substitutions: Other acceptable manufacturers offering equivalent products as approved by Architect/Engineer/Owner. Refer to Division 01 specifications for additional information.

B. (RD-1) Roof Drains - General Large Area Drains:

1. Refer to Architectural Drawings for locations and Plumbing drawings for connection sizes
2. Assembly: ASME A112.6.4.
3. Body: Lacquered cast iron with sump, outlet size as noted on plumbing drawings, connection style as required for connection to rainwater piping (Note: provide with threaded outlet in locations requiring quick turn outlet elbow)
4. Strainer: Removable cast iron dome with vandal proof screws.
5. Accessories: Coordinate with roofing type.
    a. Membrane flange and membrane clamp with integral gravel stop.
    b. Adjustable under deck clamp. (Top deck mount plate acceptable in lieu of sump reciever and under deck clamp - Contractor to indicate chosen options on submittals)
    c. Roof sump receiver. (Top deck mount plate acceptable in lieu of sump reciever and under deck clamp - Contractor to indicate chosen options on submittals)
    d. Waterproofing flange.
    e. Fixed Height non-puncturing extension sleeve for built up roof insulation.(verify required extension height in field)
    f. Quick turn elbow (where required for tight structural clearances, canopy areas etc.) JR Smith fig.# 2648S
6. Basis of Design:
    a. J.R.Smith: Model 1010-Extension-R-C-CID-1710.

C. (RD-2) Roof Drains - Terrace Low Profile Drains:

1. Refer to Architectural Drawings for locations and Plumbing drawings for connection sizes
2. Assembly: ASME A112.6.4.
3. Body: Lacquered cast iron with sump, outlet size as noted on plumbing drawings, connection style as required for connection to rainwater piping (Note: provide with threaded outlet in locations requiring quick turn outlet elbow)
4. Strainer: Removable 2-1/2 in. low profile cast iron dome with vandal proof screws.
5. Accessories: Coordinate with roofing type.
    a. Membrane flange and membrane clamp with integral gravel stop.

b. Adjustable under deck clamp. (Top deck mount plate acceptable in lieu of sump reciever and under deck clamp - Contractor to indicate chosen options on submittals)
c. Roof sump receiver. (Top deck mount plate acceptable in lieu of sump reciever and under deck clamp - Contractor to indicate chosen options on submittals)
d. Waterproofing flange.
e. Fixed Height non-puncturing extension sleeve for built up roof insulation.(verify required extension height in field)
f. Quick turn elbow (where required for tight structural clearances, canopy areas etc.) JR Smith fig.# 2648S

6. Basis of Design:
   a. J.R.Smith: Model 1010-LPDM-Extension-R-C-CID-1710.

D. (ERD-1) Emergency Roof Drains: Standpipe Type

1. Refer to Architectural Drawings for locations and Plumbing Drawings for connection sizes.
2. Lacquered cast iron body and clamp collar and bottom clamp ring; internal PVC dam extended to 4 inches above flood elevation, outlet size as noted on plumbing drawings, connection style as required for connection to rainwater piping
3. Assembly: ASME A112.6.4.
4. Body: Lacquered cast iron with sump.
5. Strainer: Removable cast iron dome with vandal proof screws.
6. Accessories: Coordinate with roofing type.
   a. Membrane flange and membrane clamp with integral gravel stop.
   b. Adjustable under deck clamp. (Top deck mount plate acceptable in lieu of sump reciever and under deck clamp - Contractor to indicate chosen options on submittals)
   c. Roof sump receiver. (Top deck mount plate acceptable in lieu of sump reciever and under deck clamp - Contractor to indicate chosen options on submittals)
   d. Waterproofing flange.
   e. Fixed Height non-puncturing extension sleeve for built-up roof insulation.(verify required extension height in field)
7. Basis of Design:
   a. J.R.Smith: Model 1070-Extension-R-C-CID-1710

E. (ERO-1) Emergency Rainwater Outlet Nozzles:

1. Nickel bronze round nozzle with spout and wall flange
2. Bird screen
3. Basis of Design:
   a. J.R. Smith Model 1770-BS, size to match pipe system.
4. Installation Note:
   a. Install Totally within the same type/color masonry, coordinate exact mounting height with architect in field prior to installation.

2.14 SHOCK ABSORBERS/WATER HAMMER ARRESTORS

A. Manufacturers:

1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.

2. Josam Company: www.josam.com.
3. Sioux Chief: www.siouxchief.com.
4. Zurn Industries, Inc: www.zurn.com.
5. Mifab Drainage Products.
6. Substitutions: Other acceptable manufacturers offering equivalent products as approved by Architect/Engineer/Owner. Refer to Division 01 specifications for additional information.

B. Water Hammer Arrestors:

1. Stainless steel construction, Bellows type or Piston type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range -100 to 300 degrees F and maximum 250 psi working pressure.

2.15 THERMOSTATIC MIXING VALVES

A. Manufacturers:

1. Acorn Engineering: T/P with Paraffin actuator.
2. Powers Valves: T/P with Paraffin actuator.
3. Zurn Industries/Wilkins: (Approved For Lavatory Tempering valves)
4. Watts: (Approved For Lavatory Tempering valves)
5. Substitutions: Other acceptable manufacturers offering equivalent products as approved by Architect/Owner prior to Bid. Refer to Division 01 specifications for additional information.

B. Lavatory Mixing Valves:

1. Temperature and pressure regulating Under-the-Counter combination tempering valves for temperature control to ASSE 1070 down to 0.5gpm. Maximum temperature setting 110°F.
   a. Powers Series LFE480 must be rated for minimum flow of 0.5 gpm.
   b. Zurn; Aquaguard Model ZW3870XLT (single temp faucet), ZW3870XLT-4P (dual temp faucet)

C. (MMV) Master Mixing Valves for Larger Flow Capacities and Domestic Water Heaters:

1. Single Hi-Lo Temperature and pressure regulating combination tempering valves for temperature control to ASSE 1017, paraffin actuator, dirt resistance seat design rotatable triple duty checkstops on inlets, rough bronze finish, w/combination temperature/pressure gauge on outlet.
   a. (MMV-#) at DWH-1: Powers LFSH1432-11, 27 gpm capacity @ 10 psi. pressure drop. ASSE 1017 rated down to 1gpm

D. (ETV-1) Emergency Eyewash / Drench Hose Mixing Valves:

1. Advanced thermal actuators, internal cold water bypass (ensures cold water flow in the event of loss of hot water), meets ASSE 1071, vandal-resistant locking mechanism to secure temperature setting, factory tested, union triple-duty checkstops, rough bronze or chrome finishes, temperature gauge on outlet.
   a. Powers HydroGuard Series Emergency Tempering Valve with Dual Internal Cold Water Bypass: Model ES-150-11 Series

2.16 TRENCH DRAINS

A. Acceptable Manufacturers

1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.

2. Josam Company: www.josam.com.
3. Zurn Industries, Inc: www.zurn.com.
4. Substitutions: Other acceptable manufacturers offering equivalent products as approved by Architect/Engineer/Owner. Refer to Division 01 specifications for additional information.

B. (TD-1) Garage Drain

1. Channels: 6" wide x 1 meter long presloped Polypropylene channels w/interlocking channels, radiused bottom, integral rebar support, and ductile iron frame with concrete frame anchors and ductile iron grate - (continuous lengths exceeding 15 meters may use alternating sloped/non-sloping channels, total quantity of channels and channel models as required to achieve length indicated on Plumbing Floor Plans drawings and Plumbing Details drawings.)
   a. Basis of Design: J.R.Smith Model 9931 series Enviroflow Trench Drain System
2. Grate: Slotted Ductile Iron, ADA compliant, quicklock securing device, with steel rails
   a. Basis of Design: JR Smith Fig No. 9870-478-MADA
3. Catch Basin: Polypropylene molded catch basin with 4 inch and 6 inch preformed no hub outlet connection, ductile iron frame, galvanized concrete anchors, and secured grate, Plastic sediment bucket.
   a. Basis of Design: JR Smith Fig. No. 9936-BP
4. Required Accessories:
   a. Closing end caps (as required per layout drawing)
   b. Adjustable trench installation supports. (quantity as required for recommended installation procedure - all thread rod with nuts and washers secured to integral rebar support)
   c. P-Trap and floor cleanout on outlet of catch basin
5. Coordinated Drawing - Trench drain Manufacturer/Supplier shall provide dimensioned drawing of coordinated trench drain layout to be included in product submittal. Layout shall include coordinated outlet locations, channel layout construction, all required accessories including endcaps, etc., and installation guides.
6. Installation: P.C. shall install trench drains in accordance with all manufacturer's recommendations. P.C. shall employ the services of the manufacturers representative to assist in installation as required and to make a minimum of one site visit to inspect installation prior to concrete pour.

2.17 WASHDOWN CONNECTION BOX

A. Manufacturers:

1. Acorn Engineering: www.acorneng.com
2. Substitutions: Other acceptable manufacturers offering equivalent products as approved by Architect/Engineer/Owner. Refer to Division 01 specifications for additional information.

B. (WB-1) Toilet Room/Locker Room Washdown Connection Box - Single Temperature

1. 304SS box, removable door with keyed cylinder lock, lead free stainless steel valve body and stop. 3/4in. Cold supply connection, 3/4" NPSH hose thread outlet connection with integral vacuum breaker, removable loose key wheel handle cartridge operated stop valve w/screwdriver stops.
2. Basis of Design: Acorn Engineering Model 8151-SSLF

2.18 WATER OUTLET CONNECTION BOX

A. Manufactures:

1. Guy Gray Corporation:
2. IPS Corporation/Water-Tite: www.ipscorp.com.
3. Oatey: www.oatey.com.
4. Substitutions: Other acceptable manufacturers offering equivalent products as approved by Architect/Engineer/Owner. Refer to Division 01 specifications for additional information.

B. (WCB-1) Water Connection Box (Refrigerator, Small Icemaker, Coffe, etc.)

1. Round ice maker outlet box with preloaded mounting nails and lead free valve with integral hammer arrester.
2. Valves comply with ASME A112.18.1.
3. Hammer arresters comply with ASSE 1010
   a. Basis of Design: IPS Model AB9200HA (SWEAT)
   b. Basis of Design: IPS Model AB9211HA (PEX-a)

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all plumbing specialties in accordance with manufacturer's instructions.

B. Roof drains

1. Review Summary of Multiple Contracts for responsibilities for furnishing, and installing roof drains. Where not specifically noted otherwise in the Summary of Multiple Contract, P.C. shall furnish and install roof drains and coordinate roof drains and roof drain installation with roofing installer.
2. Install roof drains in accordance with manufacturers installation instructions and in accordance with roofing manufacturer's recommendations to maintain full warranty of finished roofing installation. Coordinate all requirements with roofing installer prior to order/installation of drains.

C. Emergency Rainwater Outlet Nozzles

1. Unless noted otherwise emergency rainwater drainage piping shall extend down within building and penetrate exterior wall approx. 18"-24" above finish grade, and terminate with emergency drain outlet nozzle as specified in this section. Coordinate exact mounting height with architect in field prior to installation.
2. Install emergency drain outlets totally within the same type/color of exterior finish material/masonry, coordinate exact mounting height with architect in field prior to installation.

D. Cleanouts

1. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
2. Encase exterior cleanouts in concrete flush with grade.
3. Install floor cleanouts and floor drains at elevation to accommodate finished floor with strainer or cover flush with finish floor.

E. Floor drains

1. Install floor drains at elevation to accommodate finished floor with strainer or cover flush with finish floor unless specifically noted otherwise.
2. Provide Mechanical trap seal protection similar to ProSet Trapguards at all floor drain locations. Where required by Authority Having Jurisdiction, provide trap primers, trap primer connection on drain, and all associated piping to connect trap primer to drain.

F. Floor Sinks

1. Install floor sinks at elevation to accommodate finished floor with strainer or cover flush with finish floor unless specifically noted otherwise or where required to be raised above the finish floor level by the local Health Department or Authority Having Jurisdiction.

G. Backflow preventers

1. Install approved potable water protection devices on plumbing lines as indicated on drawings and where contamination of domestic water may occur; including boiler makeup water lines, chemical mixers within janitor rooms, fire sprinkler systems, irrigation systems, flush valves, interior and exterior hose bibbs. Additional backflow prevention is not required when the connected equipment is provided with integral backflow prevention in accordance with the International Plumbing Code and the equipment is permanently/directly connected to the water supply.
2. Install all backflow preventers in easily accessible location to permit annual testing and maintenance max. 48" above finish floor.
3. Provide pressure gauges on inlet and outlet piping of all backflow preventers.
4. Pipe relief from all RPZ backflow preventers air gap drain fittings to nearest floor drain or approved discharge location.

H. Shock Absorbers / Water Hammer Arrestors

1. Provide water hammer arrestors complete with accessible isolation valve on water supply piping serving with fast closing valves with flow exceeding .5gpm and flush valves (including but not limited to washing machine connection, urinals, and water closet flush valves). Water hammer arrestors shall be sized and located in accordance with PDI guidelines.

I. Non-Freeze Wall Hydrants

1. Install Approx.. 24" above grade (totally within same color masonry) Coordinate exact locations and elevations with architect prior to rough-in.

J. Thermostatic Mixing Valves

1. Install all mixing valves in strict accordance with all manufacturers recommendations and piping installation requirements.
2. Install mixing valves at the proper ASSE rating and capacities where indicated on the drawings and details. Provide mixing valves as specified above at all lavatory and handwash sink locations.

K. Trench Drains

1. Contractor shall install trench drains in accordance with all manufacturer's recommendations. Contractor shall employ the services of the manufacturers representative to assist in installation as required and to make a minimum of one site visit to inspect installation prior to concrete pour.

2. Contractor shall provide all concrete encasement and expansion control as noted on plumbing details and manufacturers installation recommendations.

END OF SECTION 22.1006

SECTION 22.1116 - DOMESTIC WATER DISTRIBUTION PIPING (PEX-A)

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Potable hot and cold water distribution system, using crosslinked polyethylene (PEX) tubing and ASTM F1960 cold expansion fittings **as an alternate**.

1. PEX-a tubing only pertains to pipe sizes 2-inch and smaller **as an alternate**.

1.2 RELATED REQUIREMENTS

A. Division 07 - Firestopping

B. Division 09 - Access Doors and Panels

C. Division 09 - Painting

D. Division 31 - Excavation, Fill and Trenching

E. Section 220502 - Excavation, Backfill and Compaction of Utilities

F. Section 220553 - Identification for Plumbing Piping and Equipment.

G. Section 220719 - Plumbing Piping Insulation.

H. Section 220516 - Expansion Fittings and Loops for Plumbing Piping.

I. Section 221006 - Plumbing Piping Specialties

1.3 REFERENCE STANDARDS

A. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to the extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.

B. ASTM International

1. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials
2. ASTM E119 Standard Test Methods for Fire Tests of Building Construction and Materials
3. ASTM E814 Standard Test Method for Fire Tests of Through-Penetration Fire Stops
4. ASTM F876 Standard Specification for Cross-linked Polyethylene (PEX) Tubing
5. ASTM F877 Standard Specification for Cross-linked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems
6. ASTM F1960 Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing

C. American National Standards Institute (ANSI)/National Sanitation Foundation (NSF)

1. ANSI/NSF Standard 14 Plastics Piping System Components and Related Materials
2. ANSI/NSF Standard 61 Drinking Water System Components - Health Effects

3. ANSI/NSF Standard 359 Valves for Crosslinked Polyethylene (PEX) Water Distribution Tubing Systems

D. American National Standards Institute (ANSI)/Underwriters Laboratories, Inc. (UL)

1. ANSI/UL 263 Standard for Safety for Fire Tests of Building Construction and Materials

E. International Code Council (ICC)

1. International Plumbing Code (IPC)
2. ICC Evaluation Service (ES) Evaluation Report No. ESR 1099

F. International Association of Plumbing Officials (IAPMO)

1. Uniform Plumbing Code (UPC)
2. IAPMO Uniform Evaluation Service (ES) Report No. 0253

G. National Association of Plumbing, Heating and Cooling Contractors (NAPHCC)

1. National Standard Plumbing Code (NSPC)

H. Plastics Pipe Institute (PPI)

1. PPI Technical Report TR-4/06

I. Uponor, Inc.

1. Uponor Piping Pocket Guide, 2017

1.4 SYSTEM DESCRIPTION

A. Design Requirements

1. Standard grade hydrostatic pressure ratings from Plastics Pipe Institute (PPI) in accordance with TR-3 as listed in TR-4. The following three standard-grade hydrostatic ratings are required.
   a. 200°F (93°C) at 80 psi (551 kPa)
   b. 180°F (82°C) at 100 psi (689 kPa)
   c. 73.4°F (23°C) at 160 psi (1,102 kPa)
2. All PEX tubing shall be installed with Uponor PEX-a Pipe Support with a maximum distance of 10” between pipe support pieces. PEX-a Pipe Support shall terminate a maximum of 5” away from the centerline of the adjacent fitting. All PEX-a tubing provided on the project shall be insulated as follows:
   a. Refer to Specification Section 22 0719 Plumbing Piping Insulation

B. Performance Requirements: To provide a PEX tubing hot and cold potable water distribution system, which is manufactured, fabricated and installed to comply with regulatory agencies and to maintain performance criteria stated by the PEX tubing manufacturer without defects, damage or failure.

1. Comply with ANSI/NSF Standard 14.
2. Comply with ANSI/NSF Standard 61.
3. Show compliance with ASTM F877.
4. Show compliance with ASTM E119 and ANSI/UL 263 through certification listings with Underwriters Laboratories, Inc. (UL).
   a. UL Design No. L557 - 1 hour wood frame floor/ceiling assemblies
   b. UL Design No. K913 - 2 hour concrete floor/ceiling assemblies
   c. UL Design No. U372 - 1 hour wood stud/gypsum wallboard wall assemblies

d. UL Design No. V444 - 1 hour steel stud/gypsum wallboard wall assemblies

1.5 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Product Data: Submit manufacturer's product submittal data and installation instructions.

C. Samples: Submit selection and verification samples of tubing.

D. Quality Assurance/Control Submittals: Submit the following:

1. Test Reports: Upon request, submit test reports from recognized testing laboratories.

E. Certificates: Submit the following:

1. Manufacturer's certificate that products comply with specified requirements.
2. Certificate indicating that the installer is authorized to install the manufacturer's products

F. Closeout Submittals: Submit the following:

1. Warranty documents specified herein
2. Operation and maintenance data

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Use an installer with demonstrated experience on projects of similar size and complexity and possessing documentation proving successful completion of PEX plumbing installation training by the PEX tubing manufacturer.

B. Regulatory Requirements and Approvals: Provide domestic potable system that complies with requirements of the following:

1. International Code Conference (ICC) - International Plumbing Code (IPC)
   a. ICC Evaluation Service (ES) Evaluation Report No. ESR 1099

C. Certifications: Provide letters of certification as follows:

1. Installer is trained by the PEX tubing manufacturer to install the PEX potable water distribution system.
2. Installer will use skilled workers holding a trade qualification license or equivalent, or apprentices under the supervision of a licensed trades professional.

1.7 DELIVERY, STORAGE AND HANDLING

A. General: Comply with Division 1 Product Requirement Section.

B. Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.

C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

D. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

1. Store PEX tubing in cartons or under cover to avoid dirt or foreign material from being introduced into the tubing.
2. Do not expose PEX tubing to direct sunlight for more than 30 days. If construction delays are encountered, provide cover to portions of tubing exposed to direct sunlight.

1.8 WARRANTY

A. Uponor offers a limited warranty of up to 25 years for its AQUAPEX® tubing and ProPEX® Fittings when installed by an Uponor-trained contractor and certified plumbing professional. See www.uponor-usa.com <http://www.uponor-usa.com/> for details in the Customer Service section.

PART 2 - PRODUCTS

2.1 HOT AND COLD POTABLE WATER DISTRIBUTION SYSTEM

A. Manufacturer: Uponor

1. Contact: 5925 148th Street West, Apple Valley, MN 55124; Toll free (800) 321-4739, (952) 891-2000; Fax: (952) 891-2008; website: www.uponor-usa.com <http://www.uponor-usa.com/>
2. Local Representative / Contact: Rich Tomkins Company; (610) 859-3552

B. MATERIALS

1. Tubing
   a. Material: Crosslinked polyethylene (PEX) manufactured by PEX-a or Engel method
      1) Type: Uponor AQUAPEX
   b. Material Standard: Manufactured in accordance with ASTM F876 and ASTM F877 and tested for compliance by an independent third party agency
   c. Standard grade hydrostatic design and pressure ratings from PPI
   d. Fire-rated assembly listings in accordance with ANSI/UL 263
      1) UL Design No. L557 - 1-hour wood frame floor/ceiling assemblies
      2) UL Design No. K913 - 2-hour concrete floor/ceiling assemblies
      3) UL Design No. U372 - 1-hour wood stud/gypsum wallboard wall assemblies
      4) UL Design No. V444 - 1-hour steel stud/gypsum wallboard wall assemblies
   e. Minimum Bend Radius (cold bending): No less than six times the outside diameter. Use a bend support as supplied by the PEX tubing manufacturer for tubing with a bend radius less than stated.
      1) Uponor Metal Bend Support #A5110xxx
      2) Uponor Plastic Bend Support #A5xxxxxx (see installation notes below)
      3) Nominal Inside Diameter: Provide tubing with nominal inside diameter, in accordance with ASTM F876 as indicated.
         (a) ½ inch [12.7mm]
         (b) ¾ inch [19.05mm]
         (c) 1 inch [25.4mm]
         (d) 1¼ inch [31.75mm]
         (e) 1½ inch [38.1mm]

(f) 2 inch [50.8mm]

f. Fittings
1) Material: Fitting assembly is manufactured from material listed in paragraph 5.1 of ASTM F1960.
2) Material Standard: Comply with ASTM F1960.
3) Expansion Fitting: PEX-a cold expansion fitting.
(a) Assembly consists of the appropriate ProPEX insert with a corresponding ProPEX Ring.
(b) Install on all domestic hot, return and cold water piping every 50 feet (max.) of straight-length horizontal piping.
(c) Refer to manufacturer's Expansion Joint Installation and Data Sheets for necessary spacing, support, anchors, guides, etc.

g. Multiport Tees
1) Uponor ProPEX 1" Copper Multiport Tee - Type L copper body with UNS 3600 series brass ProPEX outlet connections
2) Uponor engineered plastic (EP) Multiport Tee - Engineered Plastic (EP) body with ProPEX outlet connections
3) All multiport Tees manufactured with the appropriate-sized ProPEX fittings on the supply inlets.

h. Accessories
1) Angle stops and straight stops that are compatible with PEX tubing are supplied by the PEX tubing manufacturer.
2) Bend supports designed for maintaining tight radius bends are supplied by the PEX tubing manufacturer. (For use in piping drops within walls to individual fixtures only. provide Armaflex flexible elastomeric insulation in lieu of specified fiberglass insulation to achieve insulated bend)
3) ProPEX expander tool to install the ASTM F1960 compatible fittings are supplied by -Milwaukee Tool.
4) The tubing manufacturer provides clips and/or PEX rails for supporting tubing runs.
5) All horizontal tubing hangers and riser clamps are epoxy-coated material.
6) Provide pipe hangers and supports in accordance with specifications, Pex-a pipe manufacturers recommendations, IPC, All local codes, Authorities having Jurisdiction, etc.
7) Straight-Through support: Uponor # F5140500
8) Plastic Drop Ear Bend Support: Uponor #F5200xxx
9) PEX Wall Support Bracket: Uponor #A5750500
10) Metal Drop Ear Bend Support: Uponor #F5120xxx
11) PEX-a Pipe Support: Uponor #F704xxxx
12) PEX-a Pipe Support: Uponor #F704xxxx
(a) Non-combustible, self-gripping, galvanized steel channel. Provides continuous, uninterrupted support of PEX-a pipe, allowing hanger

placement similar to that of metallic pipe. Pipe Supports MUST be used on all PEX-a pipe installations.

(b) Install on all vertical and horizontal piping.

(c) Refer to the Uponor Piping Pocket Guide for installation guidelines.

2.2 VALVES:

A. All valves shall be lead free

B. Provide factory fabricated valves recommended by manufacturer for use in service indicated. Provide valves of types and pressure ratings indicated; provide proper selection as determined by installer to comply with installation requirements. Provide sizes as indicated, and connections which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.

C. Provide valves with features indicated and where not otherwise indicated, provide proper valve features as determined by installer for installation requirements. Comply with ANSI B31.1

D. BALL VALVES:

1. Acceptable Manufacturers: Subject to compliance with requirements, provide valves of one of the following:
   a. Conbraco Industries, Inc.
   b. Milwaukee Valve Co., Inc.
   c. NIBCO, Inc.
2. General: Valves shall be rated 600 PSI non-shock CWP, valve ends shall have full depth ANSI threads or extended solder connections.
3. Comply with the following standards: MSS SP-110
4. Domestic Water Service: Valves shall be rated 600 PSI non-shock CWP and will have 2-pc. lead-free * bronze body, end piece, stainless steel stem and ball, PTFE seats, full port, separate pack nut with adjustable stem packing, anti-blowout stems and have the capability of accepting extended operating handles. Valve ends shall have full depth ANSI threads or extended solder connections with Pex-A cold expansion adapter or integral Pex-A cold expansion end connections. Valves shall be 3rd party certified to NSF/ANSI-61-8Commercial Hot 180°F (including Annex F and G) and NSF/ANSI-372. Valves for use in insulated piping systems shall be equipped with 2" extended handles of non-thermal conductive material. A protective sleeve shall allow operation of the valve without disturbing the installation and providing a vapor seal. Product shall be NIBCO NIB-SEAL or approved equal.
   a. Basis of Design(threaded ends): NIBCO T585-66-LF (1/2" to 3")
   b. Basis of Design(Soldered): NIBCO S585-66-LF (1/2" to 3")

E. CHECK VALVES:

1. Check valve designed with hinged disc which seals against seat machined in bridgewall of valve body and manufactured for automatic closure by flow reversal.
2. Flanged:
   a. Valve flanges complying with ANSI B16,1 (cast iron), ANSI B16.5 (steel), or ANSI P16.24 (bronze).
3. Non-Metallic Discs:

a. Non-metallic material selected for service indicated in accordance with the manufacturer's published literature

4. Renewable Seat:
   a. Design seat of valve with removable disc, and assemble valve so disc can be replaced when worn.
5. Solder Joint:
   a. Valve ends complying with ANSI P16.18
6. Threaded:
   a. Valve ends complying with ANSI P2.1
7. Trim:
   a. Fabricate pressure-containing components of valve, including stems (shafts) and seats from brass or bronze materials, of standard alloy recognized in the valve manufacturing industry that resists dezincification.

F. CIRCUIT SETTER VALVES:

1. Construct pressure containing parts of valves as follows:
   a. Lead free construction
      1) Dezincification resistant Brass, minimum pressure rating of 300psi @ 200F
   b. Comply with ANSI B1.20.1 (NPT ends), ANSI B16.18 (soldered ends)
2. Manufacturer: Subject to compliance with requirements, provide valves of one of the following
   a. NIBCO, Inc. www.nibco.com
   b. Bell & Gosset, inc www.xyleminc.com
   c. Other acceptable manufacturers offering equivalent products as approved by Architect/Owner. Refer to Division 01 specifications for additional information.
3. Domestic Hot Water Recirculation Service:
   a. Soldered Ends:
      1) 2” and Smaller: Nibco Series S1710/T1710L
   b. Threaded Ends
      1) 2” and Smaller: Nibco Series T1710/T1710L

G. DRAIN VALVES:

1. For Low Pressure Drainage Service:
2. Soldered Ends:
   a. 2" and Smaller Class 125, bronze body, screwed bonnet, rising stem, composition disc, 3/4" hose outlet connection.
3. Threaded Ends:
   a. 2" and Smaller: Class 125, bronze body, screwed bonnet, rising stem, composition disc, 3/4" hose outlet connection,
4. Manufacturer: Subject to compliance with requirements, provide drain valves of one of the following:
   a. NIBCO, Inc. www.nibco.com
   b. Watts, inc www.watts.com
   c. Other acceptable manufacturers offering equivalent products as approved by Architect/Owner. Refer to Division 1 specifications for additional information.

H. SWING CHECK VALVES:

1. Construct pressure containing parts of valves as follows:
   a. Bronze Valves, 125 or 150 psi: ANST/ASTM B62.
   b. Comply with MSS SP-71 and MSS SP-SO for design, workmanship, material and testing. Construct valves of pressure casting free of any impregnating materials, Construct valves of bronze, regrinding, with seating angle 40 degrees to 45 degrees, unless composition disc is specified. Provide stop plug as renewable stop for disc hanger, unless otherwise specified. Construct disc and hanger as separate parts, with disc free to rotate. Support hanger pins on both ends by removable side plugs.
2. Manufacturer: Subject to compliance with requirements, provide valves of one of the following
   a. NIBCO, Inc. www.nibco.com
   b. Watts, inc www.watts.com
   c. Other acceptable manufacturers offering equivalent products as approved by Architect/Engineer/Owner. Refer to Division 01 specifications for additional information.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Comply with manufacturer's product data, including product technical bulletins, installation instructions, design drawings and the Uponor Piping Pocket Guide.

3.2 EXAMINATION

A. Site Verification of Conditions:

1. Verify that site conditions are acceptable for installation of the PEX potable water system.
2. Do not proceed with installation of the PEX potable water system until unacceptable conditions are corrected.

3.3 INSTALLATION

A. Uponor AQUAPEX Tubing

1. Install Wirsbo AQUAPEX tubing in accordance with the tubing manufacturer's recommendations and as indicated in the installation handbook.
2. Do not install PEX tubing within 6 inches [152 mm] of gas appliance vents or within 12 inches [305 mm] of any recessed light fixtures.
3. Do not solder within 18 inches [457 mm] of PEX tubing in the same waterline. Make sweat connections prior to making PEX connections.
4. Do not expose PEX tubing to direct sunlight for more than 30 days.
5. Ensure no glues, solvents, sealants or chemicals come in contact with the tubing without prior permission from the tubing manufacturer.
6. Use grommets or sleeves at the penetration for PEX tubing passing through metal studs.
7. Protect PEX tubing with sleeves where abrasion may occur.
8. Use strike protectors where PEX tubing penetrates a stud or joist and has the potential for being struck with a screw or nail.

9. Use manufacturer supplied 45 deg. or 90 deg. elbows for change of direction. Tubing bends shall be permitted for use in transition from horizontal piping to vertical piping drops within walls to serve individual fixtures only. Use tubing manufacturer supplied bend supports where bends are less than six times the outside tubing diameter. Provide Armaflex flexible elastomeric insulation in lieu of specified fiberglass insulation to achieve insulated bend.
10. Minimum horizontal supports are installed not less than 32 inches between hangers in accordance with model plumbing codes and the installation handbook.
11. PEX riser installations require riser clamps installed at the base of the deck (one per floor level).
12. A mid-story support is required for riser applications.
13. Pressurize UponorAQUAPEX tubing with air in accordance with applicable codes or in the absence of applicable codes to a pressure of 25 psi (173 kPa) above normal working pressure of the system.
14. Comply with safety precautions when pressure testing, including use of compressed air, where applicable. Do not use water to pressurize the system if ambient air temperature has the possibility of dropping below 32°F (0°C).

B. Through-penetration Firestop

1. Ensure compliance of one- and two-hour rated through penetration assemblies in accordance with ASTM E814.

C. A list of firestop manufacturers that list PEX tubing with their firestop systems is available from the PEX tubing manufacturer.

1. Related Products Installation: Refer to other sections listed in Related Sections paragraph herein for related products installation.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide manufacturer's field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance with manufacturer's instructions. Manufacturer representative to provide written report of inspection findings.

1. Site Visits: minimum of (3) 6 hr. site visits plus one final inspection.

3.5 CLEANING

A. Remove temporary coverings and protection of adjacent work areas.

B. Repair or replace damaged installed products.

C. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance.

D. Remove construction debris from project site and legally dispose of debris.

3.6 SLEEVES

A. Each Contractor shall furnish and set all sleeves required for the installation of his work and shall be responsible for their final and permanent locations.

B. All pipes passing through masonry construction shall be fitted with sleeves. Each sleeve shall extend through its respective floor or wall and shall finish flush with each surface unless otherwise required. Sleeves shall be two pipe size larger than the overall outside diameter of the pipe when

insulated. Sleeves in bearing and masonry walls shall be made of standard weight steel pipe. Sleeves through concrete floor slabs and other partitions shall be No. 2 U.S.S. gauge sheet metal.

C. All sleeves shall be properly installed and securely cemented in place. Where pipes pass through waterproofed floor or walls, design of sleeves shall be such that the waterproofing can be properly flashed around the sleeves, and of such height that the water will be restrained from entering sleeves and dripping to any finished areas below.

D. Where pipes pass through fire resisting portions of the structure, the annular space between the sleeve and the pipe shall be filled with an approved fireproof material.

3.7 INSTALLATION

A. ALIGNMENT:

1. Where several valves, piping, devices, equipment, etc., are to be installed in a common location, this equipment shall be lined up in a vertical plane. It is the Contractor's responsibility to confer with the Architect on this alignment.
2. The Mechanical and Electrical Contractors shall carefully check all the Drawings and coordinate their work with all trades to provide for a symmetrical and coordinated ceiling. Ceiling T-bars, lights, registers, and other equipment shall all be symmetrically installed with provisions made for integrating the T-bars and this equipment. Failure to coordinate will result in relocation of ceiling components as directed by the Architect at the Contractor's expense.

B. BUILDING ATTACHMENTS INSTALLATION:

1. Install building attachments at the required locations onto structural steel for proper piping support. Space attachments within the maximum piping span length indicated in MSS SP-69. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through the openings at the top of inserts. Prior to placing concrete, install nut in insert and screw threaded rod thru nut until rod is firmly against top of the insert body.

C. ESCUTCHEONS:

1. All exposed pipes, except as otherwise described, passing through walls, floors, ceilings, etc. in finished spaces, shall be provided with solid pattern heavy ceiling, floor or wall escutcheons with set screw. Escutcheons and plates shall be of steel or malleable iron with prime coat ready for painting. Escutcheons will not be provided where sleeves intentionally extend above finished floor.
2. All exposed plumbing short branch connections to fixtures and/or equipment passing through wall or floors shall be equipped with pressed brass, chromium plated, solid-type escutcheons.
3. Provide angle collars at ducts where they pass through finished walls, floors and ceilings.

D. PIPING ANCHORS INSTALLATION:

1. Install anchors at the proper location to prevent stresses from exceeding those permitted by ANSI B3l, and to prevent the transfer of loading and stresses to connection equipment.
   a. Fabricate and install anchor by welding steel shapes, plates and bars to the piping and to the structure. Comply with ANSI B3l and with AWS standards.

b. Anchor Spacing's: Where not otherwise indicated, install anchors at the ends of principal pipe runs, at intermediate points in pipe runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

E. PIPE GUIDE INSTALLATION:

1. Install pipe guides complying with the manufacturer's published product literature. Where not otherwise indicated, install pipe guides near expansion loops.

F. PIPING HANGERS & SUPPORTS:

1. Proceed with the installation of hangers, supports and anchors only after the required building structural work has been completed in areas where work is to be installed. Correct inadequacies including (but not limited to) the proper placement of inserts, anchors and other building attachments.
2. General: Install hangers, supports, clamps and attachments to support piping properly from the building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with the maximum spacing complying with MSS SP-69. Where piping of various sizes is to be supported together with trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire of perforated metal to support piping, and do not support piping from other piping.
3. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of the same type and style as installed for adjacent similar piping.
4. Prime coat exposed steel hangers and supports. Refer to Division 09 - Painting Hanger and supports located in crawl spaces, pipe shafts and suspended ceiling spaces are not considered exposed.
5. Provide hangers adjacent to motor driven equipment with vibration isolation; refer to Section 22054
6. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
7. Provide additional steel as required to span structural members for intermediate support of piping required between structural framing members. ALL piping shall be supported from structural framing members only. Coordinate all work with other trades.
   a. Do not fasten or anchor work to concrete floor deck except where individually approved by Structural Engineer and Architect.
   b. Do not fasten or anchor any work directly to metal roof deck.
   c. Prevent electrolysis in support of copper tubing by the use of hangers and supports which are copper plated, or by other recognized industry methods.
8. Provisions for movement:
   a. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate the action of expansion joints, expansion loops, expansion bends and similar units.
9. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

10. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through the insulation; do not exceed pipe stresses allowed by ANSI B31.
11. Shields/shields: Where low compressive strength insulation of vapor barriers are indicated on cold water piping, install coated protective saddles and shields.

G. ADJUSTMENT OF HANGERS AND SUPPORTS:

1. Adjust hangers and supports and place grout as required under supports to bring piping to proper levels and elevations.

H. PIPING INSPECTION:

1. General: Clean exterior surfaces of installed piping systems of superfluous materials and prepare for application of specified coatings if any. Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.

I. PIPING INSTALLATION:

1. Install all piping in accordance with International Plumbing Code (IPC), and ANSI B31 Code for Pressure Piping requirements as applicable.
2. Install pipe, tube and fittings in accordance with recognized industry practices which will achieve permanently leak proof piping systems, capable of performing each indicated service without piping failure. Install each run with a minimum of joints and couplings, but with adequate and accessible unions for disassembly and maintenance/ replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connection, within 1/16" misalignment tolerance.
3. Provide Nail Plate at Floor line where all PEX-a piping penetrates floor slab.
4. Install all piping in accordance with International Plumbing Code (IPC) and ANSI B31 Code for Pressure Piping requirements as applicable.
5. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in the shortest route which does not obstruct usable space or block access for servicing the building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanently enclosed elements of the building; limit clearance to 0.5" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1.0" clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal piping from view by locating in column enclosures, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.
6. Electrical Equipment Spaces: Do not run piping through transformer vaults and other electrical equipment spaces and enclosures.
7. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
8. Install piping to maintain headroom, conserve space, and not interfere with use of space.
9. Group piping whenever practical at common elevations.
10. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 220719
11. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Division 08 - Access Doors and Panels
12. Sleeve all piping that passes through partitions, walls and floors.

J. PIPING TESTS:

1. General: Provide temporary equipment for testing, including pumps and gages. Test piping system before insulation is installed wherever feasible and removes control devices before testing.
2. Test each natural section of each piping system independently, but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for the indicated pressure and time.
3. Test all non-gas piping systems in accordance with all requirements of IPC Section 312.
   a. Repair piping systems sections which fail the required piping tests by disassembly and reinstallation, using new materials to the extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics or other temporary repair methods.

K. PIPE GUIDE INSTALLATION:

1. Install pipe guides complying with the manufacturer's published product literature. Where not otherwise indicated, install pipe guides near expansion loops.

L. VALVE INSTALLATION:

1. General: Except as otherwise indicated, comply with the following requirements:
   a. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.
   b. Install valves with stems pointed up, in the vertical position, where possible, but in no case with stems pointed downward from a horizontal plane unless unavoidable. Install valve drains with hose-end adapter for each valve that must be installed with stem below horizontal plane.
   c. Insulation: Where insulation is indicated, install extended stem valves, arranged in the proper manner co receive insulation.
   d. Applications Subject to Shock; Install valves with bodies of metal other than cast iron where thermal or mechanical shock is indicated or can be expected to occur.
   e. Applications Subject to Corrosion: Do not install bronze valves and valve components in direct contact with steel, unless the bronze and steel are separated by a dielectric insulator. Install bronze valves in steam and condensate service and in other services where corrosion is indicated or can be expected to occur.
   f. Non-Metallic Disc: Limit the selection and installation of valves with non-metallic discs to locations indicated and where foreign material in the piping system can be expected to prevent tight shut off of metal seated valves.
   g. Renewable Seats: Select and install valves with renewable seats, except where frequent usage of the valves is indicated.

3.8 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install ball valves for shut-off and to isolate equipment, part of system or vertical risers.

C. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

D. Provide flow controls in water recirculating systems where indicated.

3.9 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed and clean.

B. Ensure Ph of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.

D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.10 PROTECTION

A. Protect installed work from damage due to subsequent construction activity on the site.

END OF SECTION 22.1116

SECTION 22.1500 - COMPRESSED AIR SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Aftercooler.

B. Air Compressor

C. Refrigerated Air Dryer.

D. Hose Reels and Accessories

E. Pipe and Pipe Fittings.

F. Pressure Reducing Station

1.2 RELATED REQUIREMENTS

A. Section 22 05 13 - Common Motor Requirements for Plumbing Equipment.

B. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

C. Section 22 05 53 - Identification for Plumbing Piping and Equipment:

D. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2010.

C. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2011.

D. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2008.

E. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 1996.

F. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturers catalog literature with capacity, weight, and electrical characteristics and connection requirements.

C. Shop Drawings: Indicate piping system schematic with electrical characteristics and connection requirements.

D. Manufacturer's Instructions: Indicate manufacturer's installation instructions, hoisting and setting requirements, starting procedures.

E. Project Record Documents: Record actual locations of equipment and components. Modify shop drawings to indicate final locations.

F. Maintenance Data: Submit for air compressor, air receiver and accessories, after cooler, refrigerated air dryer, and pressure reducing station.

G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept air compressors and piping on site in factory fabricated containers with shipping skids and plastic pipe end protectors in place. Inspect for damage.

B. Protect piping and equipment from weather and construction traffic.

1.7 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for reciprocating air compressors.

PART 2 PRODUCTS

2.1 AIR COMPRESSORS

A. Manufacturers:

1. Ingersoll Rand Compressed Air Solutions: http://air.ingersollrand.com.
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. I-R Model 2475N7.5-P or equal, two stage unit with the following features:

1. Cast iron two stage pump with Air Cooled Aftercooler Unit
2. 7.5hp, 200 volt, 3 phase motor with factory mounted starter.
3. 24 cfm with a maximum of 175 psi.
4. 80V, 80 gallon vertical tank mounting of compressor.
5. Unloading pressure switch w/unloaded start.
6. Splash lubrication system.
7. Stainless steel valves
8. ASME tank with electronic drain valve, discharge isolation valve, relief valve.
9. Baked on powder gray coat enamel
10. Provide unit with "all Season T30" lubricant.

11. Dry Clean Air Treatment package including type G & H Filter.

C. Provide new air dryer and install on outlet side of new air compressor unit.

D. Provide Intelliflow Pneumatic Flow Controller/Pressure Regulator on main supply to building.

E. Provide Filter/regulator/lubricator on each compressed air outlet: Wilkerson Model C28-06-FLG0, with the following features: Refer to plans/details for locations

1. 5 micron filter element
2. Metal bowl, polycarbonate body
3. 130 cfm rating
4. Manual drain
5. Adjustable pressure range, 0-125 psi
6. Pressure gauge
7. Integral sight dome and adjustable knob
8. Metal bowl lubricator

F. Contractor is to provide one I-R 32305898 start up kit and two 38485330 compressor maintenance kits.

2.2 AIR DRYER

A. Manufacturers:

1. Ingersoll Rand Compressed Air Solutions: http://air.ingersollrand.com.
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Type: Self contained mechanical refrigeration type complete with heat exchanger, refrigeration compressor, automatic controls, moisture removal trap, internal wiring and piping, and full R-134a refrigerant charge, NEM 12 IP/42 Protection.

C. Air Connections: Inlet and outlet connections at same level, factory insulated.

D. Heat Exchangers: Aluminum brazed plate. Provide heat exchangers with automatic control system to bypass refrigeration system on low or no load condition.

E. Moisture Separator: Centrifugal type located at discharge of heat exchanger.

F. Refrigeration Unit: Hermetically sealed type to operate continuously to maintain specified 21 degrees F dew point. House unit in steel cabinet provided with access door and panel for maintenance and inspection.

G. Accessories: Air inlet temperature gage, air inlet pressure gage, on/off switch, high temperature light, power on light, refrigerant gage, air outlet temperature gage, air outlet pressure gage, electric timer Darin valve.

H. Capacity:

1. Provide unit to meet the following criteria.
   a. Discharge Air: 38 to 50 degrees F atmospheric dew point.
   b. Rated Air Flow: 25 cfm.
   c. Inlet Air Pressure: 120 psi.

I. Electrical Characteristics:

1. 1/6 hp, 3.6 amps120 volts, single phase, 60 Hz.

J. Basis of Design: Ingersoll Rand; Model D42IN or approved equal.

2.3 PIPE AND PIPE FITTINGS

A. Steel Pipe: ASTM A53/A53M, Schedule 40 black.

1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
2. Joints: Threaded or welded to ASME B31.1.

2.4 VALVES

A. Ball Valves:

1. MSS SP-110, Class 150, 400 psi CWP, bronze, two piece body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder ends with union.

B. Swing Check Valves:

1. MSS SP-80, Class 125, bronze body and cap, bronze swing disc with rubber seat, solder ends.

2.5 UNIONS AND COUPLINGS

A. Unions:

1. Ferrous Pipe: 150 psi malleable iron threaded unions.

B. Flexible Connector: Neoprene with brass threaded connectors.

2.6 PRESSURE REDUCING VALVE

A. Pressure Reducing Station: Consisting of automatic reducing valve and bypass, and low pressure side relief valve and gage. Provide oil separator where indicated.

B. Valve Capacity: Reduce pressure from 200 psi to 30 psi, adjustable upwards from reduced pressure.

2.7 HOSE REEL AND ACCESSORIES

A. (HR-2) Ceiling mounted hose reel: consists of a spring driven hose reel with maximum 300 psi pressure, complete with 50 foot of 1/2" pressure hose and mounting bracket.

1. Provide approved quick disconnect fitting on hose outlet (fittings to match Owner's standards).
2. Provide all required support steel for mounting. Coordinate in field with building structural steel supplier.
3. Hose reel shall be Reelcraft Model A5850 OLP or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install equipment in accordance with manufacturer's instructions.

B. Install compressor unit on vibration isolators. Level and bolt in place. Refer to Section 22 05 48.

C. Make air cock and drain connection on horizontal casing.

D. Install replaceable cartridge type filter silencer of adequate capacity for each compressor.

E. Connect condensate drains to nearest floor drain.

F. Install valved drip connections at low points of piping system.

G. Install takeoffs to outlets from top of main, with shut off valve after take off. Slope take off piping to outlets.

H. Install compressed air couplings, female quick connectors, and pressure gages where outlets are indicated.

I. Install tees instead of elbows at changes in direction of piping. Fit open end of each tee with plug.

J. Identify piping system and components. Refer to Section 22 05 53.

3.2 FIELD QUALITY CONTROL

A. Compressed Air Piping Leak Test: Prior to initial operation, clean and test compressed air piping in accordance with ASME B31.1.

B. Repair or replace compressed air piping as required to eliminate leaks, and retest to demonstrate compliance.

C. Cap and seal ends of piping when not connected to mechanical equipment.

END OF SECTION 22.1500

SECTION 22.3000 - PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Domestic Hot Water Circulators.

B. Elevator Sump Pumps

C. Oil Separators

1.2 SUBMITTALS

A. Product Data:

1. Indicate pump type, capacity, power requirements.
2. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
3. Provide electrical characteristics and connection requirements.

B. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

C. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

C. Performance: Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.5 EXTRA MATERIALS

A. See Div. 01 specifications, for additional provisions.

B. Provide all required maintenance parts for up to 1 yr. for all required regular maintenance

1.6 OWNER INSTRUCTION/DEMONSTRATION

A. Provide owner instruction and demonstration for all pieces of installed equipment. Demonstration shall include: regular operating instructions, required regular maintenance, regular required maintenance

schedule for each piece of equipment. P.C. shall employ the service of a manufacturers representative where necessary or where otherwise noted in these specifications.

PART 2 PRODUCTS

2.1 DOMESTIC HOT WATER CIRCULATOR PUMPS - IN LINE

A. Manufacturers:

1. Armstrong
2. Grundfos
3. Thrush
4. Other acceptable manufacturers offering equivalent products as approved by Architect/Engineer/Owner. Refer to Division 01 specifications for additional information.

B. Casing: Lead Free Bronze or Stainless Steel rated for 125 psig working pressure, with stainless steel rotor assembly.

C. Impeller: 30% glass-filled Noryl or Bronze.

D. Shaft: Stainless steel w/permanently lubricated stainless steel bearings

E. Seal: Silicon-Carbide rotating against a stationary ceramic seat.

F. Gaskets: EPDM

G. Controls: Programmable timer and Aquastat(provide programmable timer only as required by local AHJ)

H. Performance:

1. Refer to Plumbing Detail drawings for pump sizes and requirements

2.2 ELEVATOR SUMP PUMP

A. Manufacturers:

1. Stancor Inc: www.stancorpumps.com
2. Liberty Pumps: www.libertypumps.com
3. Zoeller: www.zoeller.com
4. Other acceptable manufacturers offering equivalent products as approved by Architect/Engineer/Owner. Refer to Division 01 specifications for additional information.

B. Oil Minder Pump and Controller System

1. Pump
   a. 1/2 hp, 115v/1ph., 2" discharge, 50gpm@20ft head
   b. cast iron body with powder coated epoxy finish, stainless steel fittings
2. Stainless Steel Probes with oil detection shutdown
3. NEMA 4X simplex control panel, w/audible and visual alarm and dry alarm contacts including the following:
   a. Oil Smart ® liquid alarm switch
   b. Oil Smart ® pump switch (10-2282)
   c. 115 volts, single phase

d. NEMA 4X watertight enclosure with lockable latch
e. 30 amp motor start relay
f. Pump HOA switch
g. Top-mounted red alarm beacon light
h. 81 - 84 decibel rated alarm horn
i. Horn silence and alarm test switches
j. Alarm automatically resets
k. Dry auxiliary alarm contacts
l. Separate circuit protection for alarm
m. Circuit breaker protection
n. Pump “Run” indicator light
o. Dry pump run contact option "DPR"

4. Basis of Design: Zoeller model 153 pump and 10-2149 simplex control panel with DPR option

2.3 OIL INTERCEPTORS/SEPARATORS

A. Acceptable Manufacturers

1. Striem - striemco.com
2. Zurn/Green Turtle - zurn.com

B. (OS-1) Striem Oil Tanker Series OT-750

1. Description: seamless, rotationally-molded Polyethylene with minimum 1” uniform wall thickness, lifetime guaranteed and made in USA, furnished for above or below grade installation, integral baffle, with field adjustable riser system, built-in flow control and vent connections. Cover shall provide water/gas-tight seal and have H20 rated minimum 16,000 lbs load capacity.
2. Capacities and Characteristics:
   a. Unit Dimensions: 55 in. (dia.) x 105 in. L
   b. Max. Flow rate: 314 gpm
   c. Liquid Capacity: 750 gal.
   d. Oil Retention Capacity: 323 gal.
   e. Solids Retention Capacity: 295 gal.
   f. Inlet and Outlet Pipe Size: 4 in. (Optional 4", 6", 8" - Coordinate with size as indicated on plans)
   g. Vent Pipe Size: 3 in.(Optional 2", 3" or 4"- Coordinate with size as indicated on plans)
   h. Installation Position: Underground with accessway collar risers to grade.
   i. Options to be provided:
      1) SR/LR Teleglide Risers (Verify required length in field prior to order)
      2) C24-HP (2) - H20 Rated Pickable Cast Iron Covers
      3) CS3 - Clean Sweep Coalescing media
      4) HDK-1 - High Water Table Hold Down Kit with deadman anchors as recommended by manufacturer installation instructions.
      5) Alarm for high oil accumulation. Includes alarm probe to be installed in top of tank accessway and alarm panel with buzzer and light for indoor wall mount.

6) Oil level monitoring system oil sensorprobe and UL listed, lockable Nema 4X alarm panel with high oil level alarm light and buzzer, test button, power on light, dry contacts for BAS connection.

3. Basis of Design: Striem Oil Reserve™ oil/sand separator with Slick Stick oil level monitoring system Model No. OS-750-CS3
4. Contractor shall provide concrete reinforced relieving slab over top of entire unit, refer to details and manufacturer's recommendations for specifics on slab construction.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Coordinate with plumbing piping and related electrical work/fuel piping for each piece of equipment to achieve operating system

C. Provide Concrete housekeeping base of sufficient size for all floor mounted equipment. Concrete bases shall be dowelled into floor decking. Coordinate all work with G.C. in field.

D. Elevator Sump Pump

1. Install elevator sump pump in accordance with all PA L&I regulations and in accordance with all requirements of the local Authority Having Jurisdiction.
2. Provide conduit from elevator sump to control panel to contain wiring from sump pump to control panel. Verify required conduit size per manufacture's installation instructions prior to beginning work.

E. Domestic Hot Water Recirculation Pumps

1. Refer to Plumbing details for pump installation information and associated piping accessories.
2. Provide main circuit setter valve set to specified flow for each hot water recirculation system. Balance hot water recirculation system at all balancing valve and circuit setter valve locations to achieve timely delivery of hot water to all fixtures in accordance with IECC and local Health Department requirements.
3. Install circulation pumps in orientation as required by manufacturers recommendations.
4. Coordinate power wiring to pump and aquastat controls with E.C. in field.

F. Pumps:

1. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
2. Provide vibration isolation/flexible connectors on inlet and outlet piping

G. Oil Interceptors/Separators

1. Install Oil Interceptor/Separator in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification.
2. Install in accordance with all requirements of local AHJ.
3. Exterior Installations:

a. Verify inverts for all below grade/below slab Oil interceptors/separators prior to beginning any work.
b. Provide H-20 rated concrete relieving pad and heavy duty rated access covers as noted on plumbing drawings, details, and specifications.
c. Provide access covers extended to grade. Verify required height of access cover extensions in field prior to order of oil interceptor/separator unit. Final height of access covers shall allow grade to slope away from access covers and prevent ponding of water at access covers. Coordinate grades and slopes with site contractor to prevent ponding of water prior to beginning any work.
d. Provide manufacturers recommended anti-flotation device
e. Provide buried detectable green warning tape warning tape directly over piping and at outside edges of underground interceptors.

END OF SECTION 22.3000

SECTION 22.3400 - FUEL-FIRED WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Gas water heaters.
2. Water heater accessories.

B. Related Section: Following Division 220000 Sections contain requirements that relate to this Section:

1. Section 220519, “Meters and Gages for Plumbing Piping”
2. Section 220548, “Vibration and Isolation for Plumbing Piping and Equipment"
3. Section 220553, “Identification for Plumbing Piping and Equipment”
4. Section 220719, “Plumbing Piping Insulation”
5. Section 221005, “Plumbing Piping”
6. Section 221006, “Plumbing Piping Specialties”

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 01 Specification Sections.

B. Product Data including rated capacities of selected models, weights (shipping, installed, and operating), furnished specialties, and accessories. Indicate dimensions, finishes and coatings, required clearances, methods of assembly of components, and piping and wiring connections.

C. Product Options: Drawings indicate size, profiles, connections, dimensional requirements, and characteristics of water heaters and accessories and are based on specific types and models indicated.

D. Setting Drawings with templates and directions for installing foundation bolts, anchor bolts, and other anchorages.

E. Wiring diagrams from manufacturers detailing electrical requirements for electrical power supply wiring to water heaters. Include ladder-type wiring diagrams for interlock and control wiring required for final installation of water heaters and controls. Differentiate between factory-installed and field-installed wiring.

F. Product certificates signed by manufacturers of water heaters certifying that their products comply with specified requirements.

G. Certificates of shop inspection and data report as required by provisions of ASME Boiler and Pressure Vessel Code, when ASME construction is indicated.

H. Maintenance data for water heaters to include in operation and maintenance manuals specified in Division 01. Include startup instructions.

1.4 CERTIFICATIONS

A. AGA Standards: Comply with AGA standards and bear AGA (CSA International) certification label.

B. NFPA Standard: Comply with NFPA 70, "National Electrical Code," for electrical components.

C. Listing and Labeling: Provide electrically operated water heater controls and components specified in this Section that are listed and labeled.

D. The Terms "Listed" and "Labeled": As defined in National Electrical Code, Article 100.

E. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.5 WARRANTY

A. Manufacturer's Warranty: The Pressure vessel/tank shall carry an unconditional 5 year warranty against leakage due to defects in materials or workmanship or corrosion. The heat exchanger tubes/combustion chamber assembly shall be warranted against failure due to thermal stress failure or condensate corrosion for a prorated five year period. Component parts shall carry a limited 1 year warranty against defects in materials or workmanship. A Warranty Certificate must be issued to the Owner from the manufacturer and a copy of warranty be submitted for Engineers approval.

B. Warranty period shall begin upon turnover of equipment to owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Commercial, High-Efficiency, Down-Fired Powered-Burner Design, Low-NOx, Power Vent, Gas Water Heaters:

1. Bradford-White Corp.
2. Other acceptable manufacturers offering equivalent products as approved by Architect/Owner prior to Bid. Refer to Division 1 specifications for additional information.

2.2 WATER HEATERS, GENERAL

A. Specified manufacturer's standard components and features are acceptable where specific product requirements are not indicated.

B. Temperature Control: Adjustable thermostat, except for units where other arrangement is indicated or temperature is regulated by flow-control fitting.

C. Safety Control: Automatic, high-temperature-limit cutoff device or system on commercial units and where indicated. Include automatic low-water cutoff device or system on commercial units where indicated.

D. Interior Finish: Materials that comply with requirements of applicable NSF, AWWA, or FDA and EPA regulatory standards for tasteless and odorless, potable-water-tank linings.

E. Tappings: Factory fabricated of materials compatible with tank. Include tappings for piping connections, relief valves, pressure gage, thermometer, blow down, CPVC vent, and controls as required and others as indicated. Attach tappings to tank before testing and labeling. Include tappings and connections as follows:

1. 2-Inch NPS (DN50) and Smaller: Threaded ends.
2. 2-1/2-Inch NPS (DN65) and Larger: Flanged ends.

F. Insulation: Fiberglass, polyurethane foam, or manufacturer's standard that is suitable for operating temperature and required insulating value. Include insulation material that surrounds entire tank except connections and controls.

G. Jacket: Steel, with baked-on enamel finish, except where otherwise specified.

H. Anode Rods: Factory installed, magnesium.

2.3 COMMERCIAL, HIGH-EFFICIENC Y , CONDENSING, POWER DIRECT VENT , GAS FIRED WATER HEATERS:

A. Description: ASHRAE/IES 90.1-1999, commercial, storage, powered-vent, high efficiency gas water heater; with capacity more than 40 gal. and natural-gas input more than 75,000 Btuh.

B. Storage Tank Construction: ASME labeled, steel with 150-psig working-pressure rating.

C. Meets or exceeds SCAQMD R1146.2 low NOx requirements.

D. Burner: Manufacturer's standard, for use with powered-vent water heaters and natural-gas fuel.

E. Gas Shutoff Valve: ANSI Z21.15, manually operated. Furnish for installation in piping.

F. Pressure Regulator: ANSI Z21.18, factory or field installed, for gas appliances. Provide regulators with pressure rating, capacity, and pressure differential required for water heater and gas supply.

G. Automatic Ignition: ANSI Z21.20, automatic gas-ignition system and components.

H. Automatic Valve: ANSI Z21.21, appliance, automatic gas valve.

I. Combination Temperature and Pressure Relief Valve: ASME rated and stamped and complying with ASME PTC 25.3 and ANSI Z21.22. Include relieving capacity at least as great as heat input and pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into tank.

J. Inlet and Outlet Manifolds: Fabricated by water heater manufacturer and capable of providing balanced flow through water heaters, for multiple-unit installation.

K. Combination Temperature and Pressure Relief Valve: ASME rated and stamped and complying with ASME PTC 25.3 and ANSI Z21.22. Include relieving capacity at least as great as heat input and pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into tank.

L. Advanced Electronic Controls: Microprocessor controls ignition and thermostat, with adjustment of water temperature from 100 deg. F to 180 deg. F.

M. Basis of Design: Bradford White EF Series Ultra High Efficiency Water Heaters

1. DWH-1, DWH-2 (Building Hot Water Supply): EF-100T-199E-5NA
   a. Storage capacity: 100 gal.
   b. Gas input: 199,999 BTU
   c. Recovery: 223 gal./hr@100F
   d. First Hour Delivery: 309gal.
   e. Vent Piping: Polypropylene - Duravent or equal listed for Cat. IV fuel burning appliances
   f. Air Intake Piping: Sch. 40 PVC

g. BACnet connection kit
h. Accessories:
   1) Concrete Base Pad
   2) Gas pressure regulator to accept 2psi delivery pressure
   3) Expansion Tank - Amtrol Model ST-12-C, 4.7gal., ASME

PART 3 - EXECUTION

3.1 CONCRETE BASES

A. Install concrete bases minimum of 4 in thick, and of adequate dimensions for indicated water heaters and accessories. Refer to Division 03 Section "Cast-in-Place Concrete" and Division 220000 Sections.

3.2 WATER HEATER INSTALLATION

A. General: Install water heaters on concrete bases. Set and connect units according to manufacturer's written instructions. Install units plumb, level, and firmly anchored in locations indicated. Maintain manufacturer's recommended clearances. Install so controls and devices are accessible for service.

B. Anchor water heaters and storage tanks to substrate.

C. Install seismic restraints as required by IBC and as specified.

D. Install and connect gas water heaters according to NFPA 54.

1. Install appropriately sized gas pressure regulator on gas-burner inlets. Coordinate gas inlet pressure with plumbing drawings and water heater gas supply pressure with manufacturer prior to order/installation.
2. Install vent piping from gas burner pressure regulators and valves to building exterior in accordance with IFGC. Terminate vent piping with manufacturers recommended termination fitting including brass-screened vent cap fitting. Do not combine vents except with approval of water heater manufacturer and authorities having jurisdiction.

E. Install temperature and pressure relief valves in top portion of storage water heater tanks and hot-water storage tanks. Use relief valves with sensing elements that extend into tanks. Extend relief valve outlet with water piping in continuous downward pitch and discharge to closest floor drain.

F. Install pressure relief valves in hot-water-outlet piping for water heaters without storage. Extend relief valve outlet with water piping in continuous downward pitch and discharge to closest floor drain.

G. Install vacuum relief valves in cold-water-inlet piping.

H. Install vacuum relief valves in water heaters and hot-water storage tanks that have copper lining.

I. Install water heater drain piping as indirect waste to spill into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Section 221006 "Plumbing Piping Specialties" for drain valves.

J. Install thermometers on water heater inlet and outlet piping. Thermometers are specified in Section 220519 "Meters and Gages for Plumbing Piping"

K. Install pressure gages on water heater piping when and as indicated. Pressure gages are specified in Section 220519 "Meters and Gages for Plumbing Piping"

L. Install piping adjacent to water heaters to allow service and maintenance.

M. Arrange for field-applied insulation on equipment and piping not furnished with factory-applied insulation.

N. Install gas pressure regulator and make final connection to water heater. extend gas regulator vent to building exterior. Coordinate exact location with Architect in field. Provide downturn elbow with screened vent termination and paint exposed piping in color selected by Architect.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 220000 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. The following are specific connection requirements:

1. Connect hot- and cold-water piping to units with shutoff valves and unions. Where indicated, connect hot-water circulating piping to unit with shutoff valve, check valve, and union.
2. Connect gas piping to gas burner with drip leg, tee, shutoff valve, and union; minimum size same as inlet connection. Gas piping is specified in Section 221006 "Plumbing Piping."
3. Make connections with dielectric fittings where piping is made of dissimilar metals. Dielectric fittings are specified in Section 221006 "Plumbing Piping Specialties."

B. Electrical Connections: Power wiring and disconnect switches are specified in Division 26 Sections. Arrange wiring to allow unit servicing.

C. Grounding: Ground equipment. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 COMMISSIONING

A. Startup Services: Engage a factory-authorized service representative to provide startup service and to demonstrate and train Owner's maintenance personnel as specified below.

1. Test/adjust operating/safety controls. Replace damaged/malfunctioning controls/equipment.

B. Owner Training: Provide training for Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.

1. Review data in the operation and maintenance manuals. Refer to Division 01 Section "Contract Closeout".
2. Review data in the operation and maintenance manuals. Refer to Division 01 Section "Operation and Maintenance Data."
3. Schedule training with the Owner with at least 7 days advance notice.
4. Document and Record training. Provide video recording of training to Owner for record.

C. Perform the following final checks before startup:

1. Fill water heaters with water.
2. Charge expansion tanks with air.
3. Check that piping system tests are complete.
4. Check for piping connection leaks.
5. Check for adequate combustion air.
6. Check for clear vents and devices.
7. Check for clear relief valve inlets, outlets, and drain piping.

8. Check operation of pumps and circulators.
9. Test operation of safety controls, relief valves, and devices.

D. Perform the following startup procedures:

1. Adjust operating controls.
    a. Adjust hot-water-outlet temperature settings.

END OF SECTION 22.3400

SECTION 22.4000 - PLUMBING FIXTURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. (EEW) Emergency Eye Wash

B. (ES) Emergency Station

C. (EWC) Electric Water Coolers

D. (LAV) Lavatories.

E. (LT) Laundry Tub

F. (MR) Mop Receptors

G. (SH) Showers.

H. (SINK) Sinks.

I. (UR) Urinals

J. (WC) Water closets.

1.2 RELATED REQUIREMENTS

A. Division 01 Specifications

B. Section 07 9005 - Joint Sealers: Seal fixtures to walls and floors.

C. Section 22 1005 - Plumbing Piping.

D. Section 22 1006 - Plumbing Piping Specialties.

E. Section 22 3000 - Plumbing Equipment.

1.3 REFERENCE STANDARDS

A. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment; 2004.

B. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration; 2006.

C. ARI 1010 - Self-Contained, Mechanically-Refrigerated Drinking-Water Coolers; Air-Conditioning and Refrigeration Institute; 2002.

D. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use; The American Society of Mechanical Engineers; 1997 (Reaffirmed 2002).

E. ASME A112.18.1 - Plumbing Supply Fittings; The American Society of Mechanical Engineers; 2005.

F. ASME A112.19.2 - Vitreous China Plumbing Fixtures and Hydraulic Requirements for Water Closets and Urinals; The American Society of Mechanical Engineers; 2008.

G. ASME A112.19.3 - Stainless Steel Plumbing Fixtures; The American Society of Mechanical Engineers; 2008.

H. ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks and Urinals; The American Society of Mechanical Engineers; 2005.

I. IBC - ICC - International Building Code

J. IPC - ICC - International Plumbing Code

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Samples: Submit two lavatory supply fittings.

D. Manufacturer's Instructions: Indicate installation methods and procedures.

E. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owners's name and registered with manufacturer.

G. Maintenance Materials: Furnish the following for Owners use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Supply two sets of faucet washers.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.6 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.8 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for electric water cooler.

C. EXTRA MATERIALS

1. See Section 01 6000 - Project Requirements, for additional provisions.
2. Supply two sets of faucet washers, flush valve service kits, lavatory supply fittings, and toilet seats.
3. Supply two

PART 2 PRODUCTS

2.1 (EEW-#) EMERGENCY EYEWASH

A. Manufacturers:

1. Acorn Safety: www.acorneng.com
2. Guardian Equipment: gesafety.com
3. Haws Co.: www.hawsco.com
4. Other acceptable manufacturers offering equivalent products as approved by Architect/Owner prior to Bid. Refer to Division 1 specifications for additional information.

B. (EEW-1) WALL MOUNTED EYEWASH/DRENCH HOSE - Janitor's Closet

1. Unit shall meet the provisions of ANSI Z358.1-2014 as both an eyewash and a drench hose.
   a. Two spray heads mounted side-by-side w/ “flip top” dust covers, internal flow control and filter
   b. 1/2" IPS chrome plated brass stay-open ball valve w/flag handle.
   c. 12' retractable coiled PVC hose(Max working pressure 180 psi)
   d. Wall mounting bracket
   e. Inline backflow preventer
2. Provide signage and test/inspection record tag in accordance with ANSI Z358.1.
3. Water Supply:
   a. 1/2" Tempered supply from Tempering Valve (ETV-1)
4. Basis of Design:
   a. Guardian Safety Model: G5014-BP

2.2 (ES-#) EMERGENCY STATION (COMBINATION SHOWERS/EYEWASH)

A. Manufacturers:

1. Acorn Safety: www.acorneng.com
2. Guardian Equipment: gesafety.com
3. Haws Co.: www.hawsco.com
4. Other acceptable manufacturers offering equivalent products as approved by Architect/Owner prior to Bid. Refer to Division 1 specifications for additional information.

B. (ES-1) EYE/FACEWASH w/DRENCH HOSE - Mech/Boiler Room

1. ANSI Z358.1, Wall mounted, Eye/Facewash, SS bowl, four ABS spray heads w/ “flip top” dust covers, internal flow control and filter. annodized aluminum wall bracket
2. Provide with wall mounted drench hose unit, stay open squeeze handle, 8' hose(Max working pressure 200 psi), mounting bracket, in-line backflow preventer, and installation kit to install in combination with eyewash unit
3. Provide signage and test/inspection record tag in accordance with ANSI Z358.1.
4. Water Supply:
   a. 1/2" Tempered supply from Tempering Valve (ETV-1). Refer to specification section 22 1006 Plumbing Piping Specialties" for additional information. Locate tempering valve visible and accessible location.
5. Basis of Design: Guardian Safety Model: G1724-HS-BP

2.3 (EWC-#) ELECTRIC WATER COOLERS - REFER TO DRAWINGS FOR LOCATIONS.

A. Electric Water Cooler Manufacturers:

1. Elkay Manufacturing Company: www.elkay.com.
2. Other acceptable manufacturers offering equivalent products as approved by Architect/Owner prior to Bid. Refer to Division 01 specifications for additional information.

B. (EWC-1) SURFACE MOUNTED, BI-LEVEL - BARRIER FREE, **FILTERED**, ELECTRIC WATER COOLER w/BOTTLE FILLER (VANDAL RESISTANT) - Refer to Drawings for locations.

1. Water Cooler: Electric, mechanically refrigerated. Bi-level surface mounted with; stainless steel top, stainless steel body panels with #4 finish, elevated anti-squirt Chrome vandal resistant bubbler with flexible stream guard, automatic stream regulator, vandal resistant front push button activation, integral air cooled chiller, water filter accessible from top of unit.
2. Bottle Filler: touchless sensor activation, visual filter monitor, green ticker bottle counter, Stainless steel alcove
3. Filter: 6000gal. High capacity Lead and Microplastics filter
4. Chiller Capacity: 8 gallons per minute of 50 degrees F water with inlet at 80 degrees F and room temperature of 90 degrees F, when tested in accordance with ASHRAE Std 18.
5. Electrical: 115V, 60Hz, 260 watts, 3.8 FLA, manufacturer provided cord and plug electrical connection
6. Compliance Standards:
   a. ADA/ANSI A117.1
   b. NSF/ANSI 61 & 372
   c. NSF 42 & 53 (Filter)
   d. UL 399
7. Accessories
   a. In wall carrier
   b. Cane apron (where required for ANSI A117.1 protruding objects)
8. Basis of Design:
   a. Elkay: LVRCTL8WSPRO- LKAPRVRS - MLP200

2.4 (LAV-#) LAVATORIES

A. Manufacturers:

1. Basin: (Vitreous China)
   a. American Standard Inc: www.americanstandard.com.
   b. Sloan Valve Company: www.sloanvalve.com.
   c. Other acceptable manufacturers offering equivalent products as approved by Architect/Owner prior to Bid. Refer to Division 01 specifications for additional information.
2. Electronic Sensor Faucets:
   a. Sloan Valve Company: www.sloanvalve.com.
   b. Other acceptable manufacturers offering equivalent products as approved by Architect/Owner prior to Bid. Refer to Division 01 specifications for additional information.
3. Manual Faucets:
   a. Chicago: www.chicagofaucets.com.

b. Other acceptable manufacturers offering equivalent products as approved by Architect/Owner prior to Bid. Refer to Division 01 specifications for additional information.

4. Carriers:
   a. JOSAM Company: www.josam.com.
   b. J.R. Smith Company: www.jrsmith.com.
   c. Mifab Drainage Products
   d. Zurn Industries, Inc: www.zurn.com.
   e. Other acceptable manufacturers offering equivalent products as approved by Architect/Owner prior to Bid. Refer to Division 01 specifications for additional information.

B. (LAV-1) LAVATORY, VITREOUS CHINA, WALL HUNG - Refer to Drawings for locations.

1. Vitreous China Wall Hung Basin: ASME A112.19.2; vitreous china wall hung lavatory, 20 by 18 inch minimum, with 4 inch high backsplash, rectangular basin with splash lip, front overflow, and soap depression. Provide standard and ADA height units as designated on the Architectural Interior Elevation Plans.
   a. Drilling Centers: 4 inch.
   b. Color: White
   c. Basis of Design: American Standard: Lucerne 0355.012, 20-1/2" x 18-1/4", wall hung, drilled for concealed arm carrier system
2. Sensor Operated Faucet(EBF): Cast brass, chrome plated, deck mounted with sensor located on neck of spout.
   a. Spout Style: Standard.
   b. Power Supply: 24 VAC hardwired with Battery backup
      1) Direct wired to junction box.
      2) For 24V applications, provide transformer and low voltage wiring in accordance with all manufacturers requirements
   c. Water Supply: 3/8 inch compression connections.
   d. Aerator: Vandal resistant, 0.5 GPM, laminar flow device.
   e. Finish: Polished chrome.
   f. Basis of Design: Sloan Optima Series EBF-650-BDT-EL154 w/.5gpm VR aerator
3. Accessories:
   a. Mixing Valve: Below deck thermostatic tempering valve conforming to ASSE 1070 standard.
   b. Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon.
   c. Chrome plated perforated grid strainer.
   d. Commercial Grade, Loose key operated, 1/4 turn, chrome plated angle stops.
   e. Flexible chrome plated copper supplies.
   f. LavShield Drain and Supply shield, conforming to IAPMO standard PS94-2008 Section 3.5, ASTM E84, ANSI A117.1/ADA compliant. Custom manufactured to fit underside of lavatory basin. Stainless steel fasteners. Truebro LavShield or equal.
4. Carrier:
   a. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, concealed arm supports, bearing plate and studs.

C. (LAV-2) LAVATORY, VITREOUS CHINA, WALL HUNG - Refer to Drawings for locations.

1. Vitreous China Wall Hung Basin: ASME A112.19.2; vitreous china wall hung lavatory, 20 by 18 inch minimum, with 4 inch high backsplash, rectangular basin with splash lip, front overflow, and soap depression. Provide standard and ADA height units as designated on the Architectural Interior Elevation Plans.
   a. Drilling Centers: 4 inch.
   b. Color: White
   c. Basis of Design: American Standard: Lucerne 0355.012, 20-1/2" x 18-1/4", wall hung, drilled for concealed arm carrier system
2. Manual Faucet(Wrist Blade Handle): Solid cast brass, chrome plated, deck mounted
   a. Mounting: 4"centers
   b. Spout Style: Standard.
   c. Valve: ceramic cartridge with rotation limit stop
   d. Handles: Dual wrist blade handles with H&C color coded indicators
   e. Water Supply: 1/2 inch IPS connections.
   f. Aerator: Vandal resistant, 0.5 GPM
   g. Finish: Polished chrome.
   h. Basis of Design: Moen Commercial: Model 8215F05
      1) Chicago Faucets: Model 802-E70-317XKABCP
3. Accessories:
   a. Mixing Valve: Below deck thermostatic tempering valve conforming to ASSE 1070 standard.
   b. Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon.
   c. Chrome plated perforated grid strainer.
   d. Commercial Grade, Loose key operated, 1/4 turn, chrome plated angle stops.
   e. Flexible chrome plated copper supplies.
   f. LavShield Drain and Supply shield, conforming to IAPMO standard PS94-2008 Section 3.5, ASTM E84, ANSI A117.1/ADA compliant. Custom manufactured to fit underside of lavatory basin. Stainless steel fasteners. Truebro LavShield or equal.
4. Carrier:
   a. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, concealed arm supports, bearing plate and studs.

2.5 (MR-#) MOP RECEPTORS - REFER TO DRAWINGS FOR LOCATIONS.

A. Service Sink Manufacturers:

1. Acorn:
2. Other acceptable manufacturers offering equivalent products as approved by Architect/Engineer/Owner. Refer to Division 01 specifications for additional information.

B. (MR-1) MOP RECEPTOR - NEO-CORNER, FLOOR MOUNTED, TERAZZO

1. Basin:
   a. 24 x 24 inch x 12 inch high, terrazzo, floor mounted, neo corner style with drop front, 1 inch wide shoulders, stainless steel shoulder guard, and tiling flange.

b. Basis of design: Acorn: Model TNC-24

2. Faucet: Chrome plated cast Brass, integral vacuum breaker, pail hook, wall support
   a. Basis of design: Chicago Faucets: 897CCP
   b. Install check valves on hot and cold water supplies to faucet.
3. Accessories:
   a. KH36 hose and clamp hanger bracket, 3 feet of 5/8 inch diameter plain end reinforced rubber hose.
   b. KMH Mop hanger.
   c. KWG2-36 Stainless steel wall guards
   d. KF36 tiling flange
   e. KDG3 Drain Gasket
4. Refer to Mop Receptor Detail for additional accessories and installation. Provide HB-1 hose bibb with 3/4"C connection and provide EEW-1 Eyewash/Drench hose assembly. Refer to section 22 1006 Plumbing Piping Specialties" for additional information.

2.6 (LT-#) LAUNDRY TUB - REFER TO DRAWINGS FOR LOCATIONS.

A. Manufacturers:

1. Sink:
   a. Elkay Corporation: www.elkayusa.com.
   b. Other acceptable manufacturers offering equivalent products as approved by Architect/Owner prior to Bid. Refer to Division 01 specifications for additional information.
2. Supply Faucet:
   a. Chicago Faucet, Inc Commerical Faucets:
   b. Other acceptable manufacturers offering equivalent products as approved by Architect/Owner prior to Bid. Refer to Division 01 specifications for additional information.

B. (LT-1) - Single Compartment Laundry Tub - Laundry

1. Sink: ASME A112.19.3; 24 in.(front to back) by 27 in. (side to side) by 14 in. deep, nominal outside dimensions 14 gage thick, Type 304 stainless steel, tubular 16 ga. stainless steel legs w adjustable feet, with backsplash ledge drilled for trim (2-hole punch).
   a. Drain: 3-1/2 inch rotary lever, with grid strainer and 1-1/2" 17 ga. tailpiece.
   b. Basis of Design:
      1) Elkay; Model SS8124 w LK24RT drain outlet
2. Faucet: ASME A112.18.1; chrome plated solid brass supply with high rise 8" swivel gooseneck spout, vandal proof water economy aerator with maximum 1.5 gpm flow, 1/4 turn ceramic cartridge, 4-inch wrist blade indexed lever handles, wall mount style, two holes on 8" centers.
   a. Basis of Design:
      1) Chicago: 631-GN8AE35ABCP, w/8" gooseneck swivel spout and 1.5gpm vandal resistant aerator)
3. Accessories: Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon, screwdriver/loose key chrome plated 1/4 turn angle stops, rigid chrome plated copper or flexible woven stainless steel supplies.

2.7 (SH-#) SHOWERS

A. Manufacturers

1. Controls/Valving
   a. Chicago Faucet, Inc Commerical Faucets: chicagofaucets.com
   b. Powers Controls: www.powerscontrols.com
   c. Other acceptable manufacturers offering equivalent products as approved by Architect/Owner prior to Bid. Refer to Division 01 specifications for additional information.

B. (SH-1) SHOWER UNIT w/MANUAL CONTROL - ADA

1. Surround/Base - By others
2. Control Valve and Accessories
   a. All Chrome Plated Metal Construction control valve, handshower and slide bar
   b. Thermostatic/Pressure balancing mixing valve(ASSE 1016) with brass cartridge, deluxe chrome plated metal handle, high temperature limit stop, integral service staops w/checks
   c. 1/2" hot and cold water supply.
   d. ANSI A117.1 compliant, 1.5gpm hand shower with pause button 59"-69" metal hose, and slide bar.
   e. Basis of Design:
      1) Chicago: SH-TP4-00-021 (provide with 1.5-2.0 gpm handshower)

2.8 (SINK-#) SINKS - REFER TO DRAWINGS FOR LOCATIONS.

A. CONTRACTOR SHALL COORDINATE SPECIFIED SINK TYPE, SIZE, AND DIMENSIONAL REQUIREMENTS **WITH CASEWORK SUPPLIER IN FIELD PRIORTO RELEASE OF ORDER**. Contractor is responsible for final verification of size and type.

B. Manufacturers:

1. Sink:
   a. Elkay Corporation: www.elkayusa.com.
   b. Other acceptable manufacturers offering equivalent products as approved by Architect/Owner prior to Bid. Refer to Division 01 specifications for additional information.
2. Supply Faucet:
   a. Chicago Faucet, Inc Commerical Faucets:
   b. Other acceptable manufacturers offering equivalent products as approved by Architect/Owner prior to Bid. Refer to Division 01 specifications for additional information.

C. (SINK-1) - Single Compartment Bowl - ADA - General Sink.

1. Undermount Sink: ASME A112.19.3; 16 in.(front to back) by 18-1/2 in. (side to side) by 5-3/8 in. (ADA) nominal outside dimensions 18 gage thick, Type 304 stainless steel, undermount, undercoated.
   a. Drain: 3-1/2 inch all metal crumb cup with strainer and 17 ga.tailpiece.(ADA units shall be provided with drain outlet centered-rear in bowl
   b. Basis of Design: Elkay; Model ELUHAD 131655

2. Faucet: ASME A112.18.1; chrome plated brass supply with high rise 8" rigid gooseneck spout, vandal proof water economy aerator with maximum 1.5 gpm flow, 1/4 turn ceramic cartridge, 4-inch wrist blade indexed lever handles.
    a. Basis of Design:
        1) Chicago Faucets: 201-G8AE35-317XKA
3. Accessories: Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon, screwdriver/loose key chrome plated 1/4 turn angle stops, rigid chrome plated copper or flexible woven stainless steel supplies.
4. Below deck thermostatic mixing valve, ASSE-1070 compliant. Provide on Hot supply to faucet. Zurn Aquaguard 38-ZW1070XLCOMP
5. Drain and Supply Insulating covers, conforming to IAPMO standard PS94-2008 Section 3.5, ASTM E84

D. (SINK-2) - Single Compartment Bowl - ADA - Community Pantry

1. Undermount Sink: ASME A112.19.3, ANSI A117.1/ADA; 18 gage thick, Type 304 stainless steel, undercoated.
    a. Bowl Size: 15-3/4 in.(front to back) by 21 in. (side to side) by 5-1/2 in. deep
    b. Overall dimension: 18-1/4 in.(front to back) by 23-1/2 in. (side to side) by 5-1/2 in. deep
    c. Drain: 3-1/2 inch all metal crumb cup with strainer and 17 ga.tailpiece.(ADA units shall be provided with drain outlet centered-rear in bowl
    d. Basis of Design:
        1) Elkay; Model ELUHAD211555 (5.5" Deep, Center-Rear Drain)
2. Faucet: ASME A112.18.1; chrome plated metal construction, high arc swivel spout with pulldown spray, lever style handle w/duralast cartridge, 1.5 gpm.
    a. Basis of Design:
        1) Chicago 434-ABCP
3. Accessories: Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon, screwdriver/loose key chrome plated 1/4 turn angle stops, rigid chrome plated copper or flexible woven stainless steel supplies.
4. Drain and Supply Insulating covers, conforming to IAPMO standard PS94-2008 Section 3.5, ASTM E84

E. (SINK-3) - Double Bowl - Dayroom Kitchen Sink

1. Undermount Sink: ASME A112.19.3; 16 gage thick, Stainless steel, undercoated.
    a. Bowl Size: 14in.(front to back) by 15 in. (side to side) by 8 in. deep
    b. Drain: 3-1/2 inch all metal crumb cup with strainer and 17 ga.tailpiece. (ADA units shall be provided with drain outlet centered-rear in bowl
    c. Basis of Design:
        1) Elkay Dayton DXUH3118
2. Faucet: ASME A112.18.1; chrome plated metal construction, high arc swivel spout with pulldown spray, lever style handle w/duralast cartridge, 1.5 gpm.
    a. Basis of Design:
        1) Chicago 434-ABCP
3. Accessories: Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon, screwdriver/loose key chrome plated 1/4 turn angle stops, rigid chrome plated copper or flexible woven stainless steel supplies.

4. Below deck thermostatic mixing valve, ASSE-1070 compliant. Provide on Hot supply to faucet. Zurn Aquaguard 38-ZW1070XLCOMP
5. Drain and Supply Insulating covers, conforming to IAPMO standard PS94-2008 Section 3.5, ASTM E84

F. (SINK-4) - Triple Bowl - Decon

1. Sink: Triple bowl ASME A112.19.3; 14 gage thick, Type 300 stainless steel, tubular 16 ga. stainless steel legs w adjustable feet, with backsplash ledge drilled for trim (2-hole punch).
   a. Bowl Size: 20in. by 20 in. by 14 in.
   b. Overall dimension: 104-1/2 in. by 25 in. by 43 in.
   c. Drain: 3-1/2 inch all metal crumb cup with strainer and 17 ga.tailpiece.(ADA units shall be provided with drain outlet centered-rear in bowl
   d. Basis of Design:
      1) Elkay; Model 14-3C20X20-0X
2. Faucet: ASME A112.18.1; chrome plated solid brass supply with high rise 8" swivel gooseneck spout, vandal proof water economy aerator with maximum 1.5 gpm flow, 1/4 turn ceramic cartridge, 4-inch wrist blade indexed lever handles, wall mount style, two holes on 8" centers.
   a. Basis of Design:
      1) Chicago: 631-GN8AE35ABCP, w/8" gooseneck swivel spout and 1.5gpm vandal resistant aerator)
3. Accessories: Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon, screwdriver/loose key chrome plated 1/4 turn angle stops, rigid chrome plated copper or flexible woven stainless steel supplies.
4. Below deck thermostatic mixing valve, ASSE-1070 compliant. Provide on Hot supply to faucet. Zurn Aquaguard 38-ZW1070XLCOMP
5. Drain and Supply Insulating covers, conforming to IAPMO standard PS94-2008 Section 3.5, ASTM E84

2.9 (UR-#) URINALS

A. Manufacturers:

1. Urinal
   a. American Standard Inc: www.americanstandard.com.
   b. Other acceptable manufacturers offering equivalent products as approved by Architect/Owner prior to Bid. Refer to Division 01 specifications for additional information.
2. Flush Valves:
   a. Sloan Valve Company: www.sloanvalve.com.
   b. Other acceptable manufacturers offering equivalent products as approved by Architect/Owner prior to Bid. Refer to Division 01 specifications for additional information.
3. Carriers:
   a. JOSAM Company: www.josam.com.
   b. J.R. Smith Company: www.jrsmith.com.
   c. Mifab Drainage Products
   d. Zurn Industries, Inc: www.zurn.com.

e. Other acceptable manufacturers offering equivalent products as approved by Architect/Owner prior to Bid. Refer to Division 01 specifications for additional information.

B. (UR-1) URINAL - WALL HUNG

1. Urinal: Vitreous china, white, stain resistant antimicrobial finish; ASME A112.19.2, washout style, wall hung with side shields and concealed carrier. Mount at standard and ADA height units as designated on Architectural Interior Elevation Plans.
   a. Flush Volume: 0.125 gpf - 1.0 gpf
   b. Flush Style: Washout.
   c. Supply Connection: Exposed (top spud).
   d. Trap: Integral.
   e. Removable stainless steel strainer.
   f. Supply Size: 3/4 inch.
   g. Outlet Size: 2 inches.
   h. Basis of Design:
      1) American Standard Inc; Model Washbrook 6590.001EC, wall hung, top spud, with everclean
2. Flush Valves(Hardwired): ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.
   a. Sensor-Operated Type: Solenoid operator, low voltage hard-wired, infrared sensor and True Mechanical Over-ride push button on valve body..
   b. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop.
   c. Flush Volume: .5 gpf
   d. Basis of Design:
      1) Sloan Valve Company; Model Optima Royal Series 186 ESS-0.5-TMO, EL-154 transformer and all necessary low voltage cables for complete installation.
3. Carriers:
   a. ASME A112.6.1M; compact adjustable cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs.

2.10 (WC-#) WATER CLOSETS

A. Manufacturers(All Water Closets)

1. Bowl:
   a. American Standard Inc: www.americanstandard.com.
   b. Other acceptable manufacturers offering equivalent products as approved by Architect/Owner prior to Bid. Refer to Division 01 specifications for additional information.
2. Flush Valves:
   a. Sloan Valve Company: www.sloanvalve.com.
   b. Other acceptable manufacturers offering equivalent products as approved by Architect/Owner prior to Bid. Refer to Division 01 specifications for additional information.
3. Seats:
   a. American Standard: www.americanstandard.us.com
   b. Kohler Company: www.kohler.com.

c. Bemis Manufacturing Company: www.bemismfg.com.
d. Olsonite: www.olsonite.com.
e. Kohler Company: www.kohler.com.
f. Zurn industries, Inc: www.zurn.com.
g. Other acceptable manufacturers offering equivalent products as approved by Architect/Owner prior to Bid. Refer to Division 01 specifications for additional information.

4. Carriers:
   a. JOSAM Company: www.josam.com.
   b. J.R. Smith Company: www.jrsmith.com.
   c. Mifab Drainage Products
   d. Zurn Industries, Inc: www.zurn.com.
   e. Other acceptable manufacturers offering equivalent products as approved by Architect/Owner prior to Bid. Refer to Division 01 specifications for additional information.

B. (WC-1) WATER CLOSET, WALL HUNG (Public Toilet Rooms) Refer to Drawings for locations.

1. Bowl: Vitreous china w/stain resistant antimicrobial finish, White, ASME A112.19.2, ANSI A117.1/ADA compliant, elongated rim, wall hung, siphon jet flush action, china bolt caps. Provide standard and ADA height units as designated on the Architectural Interior Elevation Plans.
   a. Flush Volume: 1.1 - 1.6 gallon per flush
   b. Supply Connection: 1-1/2 inch Top Spud
   c. Outlet Size: 4 in.
   d. Basis of Design:
      1) American Standard Inc; Model Afwall Millenium FloWise 3351.101 (wall hung, elongated, top spud)
2. Flush Valve (Hardwired): ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.
   a. Sensor-Operated Type: Solenoid operator, low voltage hard-wired, infrared sensor and True Mechanical Over-ride push button on valve body.
   b. Exposed Type: All Chrome plated, sweat solder adapter with cover tube and cast wall flange, 1" screwdriver angle stop w/vandal resistant stop cap.
   c. Power Supply: 24 VAC.
      1) Direct wired to junction box.
      2) For 24V applications, provide transformer and all low voltage wiring from transformer to faucets/flush valves. Power wirng to transformer shall be provided by the E.C.
   d. Flush Volume: 1.6gpf
   e. Basis of design:
      1) Sloan Valve Company; Model Royal 111 ESS-1.28-TMO, EL-154 tansformer and all necessary low voltage cables for complete installation
3. Seats:
   a. Solid white plastic, elongated, open front, extended back, stainless steel self-sustaining hinge, stainless steel or brass bolts, without cover and anti-microbial finish.

4. Water Closet Carriers:
   a. ASME A112.6.1M; adjustable compact cast iron frame, minimum 500 lbs static load rating, integral drain hub and vent, metal nipple assembly, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers. Provide horizontal and vertical drain units as required by installation methods.

C. (WC-2) WATER CLOSET, WALL HUNG (Single Toilet Rooms) Refer to Drawings for locations.

1. Bowl: Vitreous china w/stain resistant antimicrobial finish, White, ASME A112.19.2, ANSI A117.1/ADA compliant, elongated rim, wall hung, siphon jet flush action, china bolt caps. Provide standard and ADA height units as designated on the Architectural Interior Elevation Plans.
   a. Flush Volume: 1.1 - 1.6 gallon per flush
   b. Supply Connection: 1-1/2 inch Top Spud
   c. Outlet Size: 4 in.
   d. Basis of Design:
      1) American Standard Inc; Model Afwall Millenium FloWise 3351.101 (wall hung, elongated, top spud)
2. Flush Valve (Hardwired): ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.
   a. Sensor-Operated Type: Solenoid operator, low voltage hard-wired, infrared sensor and True Mechanical Over-ride push button on valve body.
   b. Exposed Type: All Chrome plated, sweat solder adapter with cover tube and cast wall flange, 1" screwdriver angle stop w/vandal resistant stop cap.
   c. Power Supply: 24 VAC.
      1) Direct wired to junction box.
      2) For 24V applications, provide transformer and all low voltage wiring from transformer to faucets/flush valves. Power wirng to transformer shall be provided by the E.C.
   d. Flush Volume: 1.6gpf
   e. Basis of design:
      1) Sloan Valve Company; Model Royal 111 ESS-1.28-TMO, EL-154 tansformer and all necessary low voltage cables for complete installation
3. Seats:
   a. Solid white plastic, elongated, open front, extended back, stainless steel self-sustaining hinge, stainless steel or brass bolts, without cover and anti-microbial finish.
4. Water Closet Carriers:
   a. ASME A112.6.1M; adjustable compact cast iron frame, minimum 500 lbs static load rating, integral drain hub and vent, metal nipple assembly, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers. Provide horizontal and vertical drain units as required by installation methods.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall carriers and bolts.

E. Seal fixtures to wall and floor surfaces with sealant as specified in Section 07 9005, color to match fixture.

F. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

G. Provide all transformers and low voltage wiring required for connection of plumbing fixtures. Install transformers and low voltage wiring in accordance with all manufacturers' requirements and recommendations. Line voltage power supply to the transformer shall be provided by the E.C.

3.4 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.5 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

A. Clean plumbing fixtures and equipment.

3.7 SCHEDULES

A. Fixture Heights: Install fixtures to heights above finished floor as scheduled below, where not indicated otherwise on Achitectural Interior Elevations and Drawings.

1. Water Closet:
    a. Standard: 15 inches to top of bowl.
    b. Accessible: 18 inches (17 inches min. - 19 inches max.) to top of seat.

c. Accessible (Childerens Use - age 12 and younger): 15 inches (11 inches - 17 inches)

2. Water Closet Flush Valves:
   a. Standard: 11 inches min. above bowl rim. (coordinate installation at Accessible locations with manufacturers reccomendations.)
   b. Accessible: 11 inches min. above bowl rim. max 44 inches above floor (field coordinate installation at Accessible locations with manufacturers reccomendations and grab bar installation.)
3. Urinal:
   a. Standard: 24 inches to top of bowl rim.
   b. Accessible: 16 inches (17 inches max.) to top of bowl rim.
4. Lavatory:
   a. Standard: 31 inches - 34 inches to top of basin rim.
   b. Accessible: 34 inches(max.) to top of basin rim.
5. Drinking Fountain:
   a. Standard Adult: 40 inches (38 inches - 43 inches) to spout.
   b. Accessible: wheelchair (lower bowl) - 36 inches max. to top of spout.
   c. Accessible: standing persons (upper bowl) - (38 inches min.- 43 inches max.) to spout
6. Emergency Eye and Face Wash:
   a. Standard: 36 inches to receptor rim
   b. Accessible: 36 inches max. to spray heads
7. Showers:
   a. Standard: Male - 80 inches to showerhead, Female - 80 inches to showerhead.
   b. Accessible: Locate all controls 38 inches minimum-48 inches max above floor (measured from floor to highest point of control)

B. Fixture Rough-In Minimum rough in connection sizes indicated. Refer to plans for branch piping and DWV system connections)

1. Drinking Fountain/EWC:
   a. Cold Water: 1/2 Inch.
   b. Waste: 1-1/4 Inch.
2. Lavatory:
   a. Hot Water: 1/2 Inch.
   b. Cold Water: 1/2 Inch.
   c. Waste: 1-1/2 Inch.
3. Sink:
   a. Hot Water: 1/2 Inch.
   b. Cold Water: 1/2 Inch.
   c. Waste: 1-1/2 inch.
4. Mop Basin:
   a. Hot Water: 1/2 Inch.
   b. Cold Water: 1/2 Inch.
   c. Waste: 3 Inch.
5. Showers (refer to plans and product specifications for supplies required)
   a. Hot Water: 1/2 Inch.

b. Cold Water: 1/2 Inch.
c. Tempered Water: 1/2 Inch.

6. Urinal (Flush Valve Type):
   a. Cold Water: 3/4 Inch.
   b. Waste: 2 Inch.
7. Water Closet (Flush Valve Type):
   a. Cold Water: 1 Inch.
   b. Waste: 4 Inch.

END OF SECTION 22.4000

SECTION 23.0501 – HVAC GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work specified in this section. These General Provisions are in addition to all requirements of Division 01 specifications. Where requirements of this section are in conflict with the requirements of Division 01 specification requirements, the requirements of Division 01 take precedence.

1.2 CONTRACTOR:

A. The term Contractor as used in the Specifications shall be understood to mean the people or firm awarded the Contract for the respective phases of work - Heating, Ventilating and/or Air Conditioning.

1.3 DRAWINGS:

A. Drawings are part of the bid documents and are intended to show approximate and relative locations of services and equipment. They shall not be scaled to determine exact positions, locations, and clearances.

B. Due to the diagrammatic layout and small scale of the drawings, certain piping and duct rises, drops, offsets, valves, and related specialties are not shown. The contractor shall provide all ductwork, piping, fittings, valves, and specialties required to insure a complete installation without additional cost to the owner.

C. All drawings and specifications pertaining to general construction, plumbing, HVAC, electrical, and other work shall be carefully examined. Where physical interferences with his work occur because of his failure to consult other trades, this Contractor shall rearrange his work at his own expense.

1.4 TRUE INTENT:

A. The Drawings and Specifications are intended to provide a complete and perfectly operating system. Therefore, it is specifically agreed and understood by the Contractor that anything, be it labor, material or equipment, which is not described in the Specifications or specifically shown on the Drawings, but is necessary for the operation and completion of a perfectly operating system, according to the true intent of the Specifications and Drawings and as interpreted by the Architect, shall be furnished by the Contractor as a part of his Contract, at no extra charge, as though it were specifically detailed and described.

1.5 DEFINITIONS:

A. Where the word "provide" is used in connection with a system, equipment, or an item it shall be understood to mean the furnishing and installing of the system, equipment or item on this project.

B. Where the phrase "as directed" is used, it shall be understood to mean as directed or instructed by the Architect or his authorized representative.

C. Where the word "shall" appears in these Specifications, it shall be understood to mean that the labor, material or performance which it describes, or is associated, is mandatory.

D. Where the words "to be" appear in these Specifications, it shall be understood to have the same interpretation as if the word "shall be" were inserted in their place.

E. Where the word "comparable" appears in these Specifications, it shall be understood to mean that any item of equipment or material which is specified with an absolute minimum of differences.

1.6 SCOPE:

A. Provide a complete and operating HVAC system in accordance with these specifications and accompanying contract drawings. This shall include all required labor, materials, equipment, and supervision.

B. Work shall include but is not limited to the following systems, equipment, materials, and labor for a complete system including the following:

1. Ductwork
2. Air Handling Units
3. Diffusers, grilles, and registers
4. Exhaust fans and relief vents
5. Air terminal units
6. Hot water, refrigerant, and condensate piping systems
7. Terminal heating equipment
8. Automatic temperature control system
9. Boilers
10. Pumps
11. Split system cooling units

1.7 PHASING:

A. All work shall be undertaken to accomplish the work in phases as indicated on the phasing drawings and descriptions.

B. All work required to accomplish the work in the phases shall be included.

1.8 VISIT TO THE SITE

A. Prior to submission of his bid, the Contractor shall visit the site to acquaint himself with the existing conditions. Bids as submitted will be interpreted to include all cost and change made necessary by such conditions.

1.9 RULES AND REGULATIONS

A. All work shall be performed in accordance with the rules and regulations of Pennsylvania Department of Labor and Industry, Federal Department of Labor (Occupational Safety and Health Administration), the Department of Education, the Department of Environmental Protection, and all codes and agencies having jurisdiction.

B. All construction, design fabrication, tests, rating and installation shall comply with the rules and regulations of all local, state or national codes and agencies having jurisdiction over this project. Any costs involved in complying to these rules and regulations shall be included in original bid of this Contractor.

C. The Owner will obtain the building permit. Any other fees relative to the contractors work shall be paid by the contractor as part of his Bid.

1.10 FOREMAN

A. Each contractor must provide a competent foreman, subject to approval of the Construction Manager and Architect. The foreman shall be deemed the agent of the Contractor and must be on duty at the building during all working hours. If work is occurring in more than one shift, provide a foreman for each shift.

B. Any instructions or notices given to the foreman shall have the same force as if given to the Contractor in person.

1.11 WORKMANSHIP

A. All workmanship shall be done according to the best practices of the trade by qualified and competent tradesmen.

1.12 WORK RESPONSIBILITY:

A. All base flashing shall be provided by the General Contractor, with all counterflashing by this contractor.

B. All structural supports required for the installation of equipment and materials shall be furnished by this contractor unless specifically shown on the structural drawings.

C. All concrete work and pads for the installation of equipment and materials shall be furnished by this contractor unless specifically shown on the general construction drawings.

1.13 COORDINATION OF WORK

A. Contractor shall coordinate his work with the other trades. In case of interference or problems the Architect shall decide which work is to be relocated, regardless of which is installed first.

1.14 ALIGNMENT:

A. Where several receptacles, devices, bells, alarms, thermostats, switches, handles, etc., are to be installed in a common location, this equipment shall be lined up in a vertical plane. It is the Contractor's responsibility to confer with the Architect on this alignment.

B. The Mechanical and Electrical Contractors shall carefully check all the Drawings and coordinate their work with all trades to provide for a symmetrical and coordinated ceiling. Ceiling T-bars, lights, registers, and other equipment shall all be symmetrically installed with provisions made for integrating the T-bars and this equipment. Failure to coordinate will result in relocation of ceiling components as directed by the Architect at the Contractor's expense.

1.15 LOCATION OF EQUIPMENT

A. All locations of plumbing, HVAC and fire protection equipment and pipe connections there to shall be verified by the Engineer and Architect. The contractor shall verify locations sufficiently in advance of the installation to allow uninterrupted progress of the work of all trades.

B. The Mechanical Contractor shall prepare dimensioned coordination/arrangement drawings at a scale of (1/4" = 1'0"). Layouts represented by these drawings shall be coordinated with all other trades. Refer to Division 1 requirements for project coordination.

C. This Contractor shall obtain Architect approval of all arrangement drawings before continuing his work.

1.16 MATERIALS AND EQUIPMENT

A. All materials and equipment, unless otherwise specified, shall be new and of the best quality, approved for their specific application.

B. This Contractor shall provide, when required by the Architect, labeled samples of materials to be used on this project. Samples shall be submitted for approval to the Architect prior to their installation.

C. All materials and equipment installed by the Contractor shall be securely and rigidly supported from or attached to the building structure.

1.17 FIRE UNDERWRITER SEAL:

A. Where applicable, all material shall bear the National Board of Fire Underwriters' Seal of Approval. Certificates to this effect to be furnished to Architect upon request.

1.18 SUBMISSION OF SHOP DRAWINGS, EQUIPMENT, AND MATERIALS

A. The Contractor shall submit, with a letter of transmittal to the Architect, 6 sets of shop drawings containing all capacities, performances, features, options, accessories and technical data of all materials and equipment listed herein. All submittals shall be made within 45 days after awarding of the contract.

B. Refer to Division 1.

C. All disapproved submittals shall be corrected as directed by the Architect and resubmitted in 6 sets until approved within 30 days after the original submittal was disapproved. No work involving any materials or equipment covered by shop drawings shall be started until the respective shop drawings are approved.

D. Submit electric copies of all submittals to the Construction Manager.

E. No equipment or materials shall be installed until final approval has been given by the Architect.

F. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number and specification section number, as appropriate on shop drawings.

G. On shop drawings, apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the Work and Contractor Documents.

H. On shop drawings, provide space for Contractor and Architect/Engineer review stamps.

I. Contractors shall include with each submittal/shop drawing, a matrix outlining all items that do not match the specified unit. If an item is not listed on the matrix, the submitted unit will be assumed to meet all parts of the specification. Contractors will be responsible to ensure that the specifications are met in full. Items in matrix shall include schedule performance data vs submitted performance data, specified components vs submitted unit components, specified construction weight, warranty, etc. vs submitted construction, weight, warranty, etc.

1.19 APPROVED SUBSTITUTIONS:

A. Various items of equipment and materials that have been used as the basis for mechanical system design have been specified by a manufacturer's name and model number. Another manufacturer's product may listed within the specifications as an approved substitution. The Architect shall be the sole judge as to the comparability of an item of equipment that is submitted for approval as a substitute for that which is specified. Each of the Contractor's substitute proposals shall include all labor and materials that will be required to install the equipment and make it operate satisfactorily in accordance with the original design concept. He shall include such things as changes in piping, valves, supports, fittings, ductwork, motors, controls, electrical wiring, and thermal insulation. It shall be the responsibility of the Contractor to make certain that substitute equipment, which has been accepted by the Architect will fit into the designated spaces. He shall make the necessary field measurements in order to determine that there is adequate space for the equipment, taking into consideration the clearances that are required for connections and servicing. All equipment other than the basis of design shall be considered a substitution.

1.20 ALTERNATES:

A. Various items of equipment and materials that have been used as a basis for mechanical system design have been specified by a manufacturer's name and model number. Where another manufacturer's product has been specified as an alternate to this equipment the proposed cost for this alternate shall include all labor and materials that will be required to install the equipment and make it operate satisfactorily in accordance with the original design concept. He shall include such things as changes in piping, valves, supports and supporting structure, fittings, ductwork, motors, controls, electrical wiring and thermal insulation. It shall be the responsibility of the contractor to make certain the alternate equipment will fit into the designated spaces. He shall make the necessary field measurements in order to determine that there is adequate space for the equipment, taking into consideration the clearances that are required for connections and servicing.

1.21 PROTECTION OF EQUIPMENT

A. The Contractor shall protect all material and equipment from damage until final acceptance as installed. He shall close all openings during construction with temporary plugs and replace all damaged items with ones of exact sameness at his expense.

B. The Contractor shall schedule material and systems for delivery in such a pattern that critical pieces of equipment may be stored within the building, protected from weather. Where materials are stored outside, they must be protected from the elements and damage.

C. This Contractor shall be responsible for coordinating the procurement of specified materials and equipment being supplied by his sub-contractors and suppliers.

1.22 SCAFFOLDING AND HOISTING

A. The Contractor shall furnish and erect all scaffolding, hoists, shoring, platforms, railings, ladders, and other devices required by local, state, and federal laws to install his systems and equipment. Scaffolding and all other equipment shall be removed at completion of the work.

B. The Contractor shall hoist or rig his own material and equipment into place, or arrange for the rigging of it by others at his expense.

1.23 CONCRETE AND MASONRY WORK:

A. The Contractor shall furnish and install all concrete bases, reinforcing, etc. required to install the Mechanical Work, unless otherwise noted.

B. The Contractor, prior to installing any forms, reinforcing or concrete, shall notify all other Contractors or subcontractors, in ample time for them to install any portion of their work which is to be concealed in the concrete. No such work shall be placed in a manner to interfere with the proper placing of the reinforcement unless so authorized by the Architect.

1.24 ANCHOR BOLTS:

A. Each Contractor shall provide and set in place at the time the foundations, bases, or curbs are poured, all necessary anchor bolts as required for the various equipment specified herein, to be furnished by him under these Specifications. Anchor bolts must be of the hook type and of the proper sizes and length to suit the apparatus. The bolts shall be set in pipe sleeves of approximately twice the bolt diameter and as long as the imbedded length of the bolt.

B. When the equipment is set in its proper position, the bolt sleeves and the space between the rough foundations, bases or curbs of the equipment shall be completely filled with one inch of non- shrinking cement grout.

C. Each Contractor shall assume all responsibility for the location of all anchor bolts for the equipment furnished by him under these Specifications, and must have a man present at the time the foundation, bases, or curbs are poured.

1.25 SLEEVES:

A. Each Contractor shall furnish and set all sleeves required for the installation of his work and shall be responsible for their final and permanent locations.

B. All pipes passing through masonry construction shall be fitted with sleeves. Each sleeve shall extend through its respective floor or wall and shall finish flush with each surface unless otherwise required. Unless otherwise specified or shown, sleeves shall be one pipe size larger than the overall outside diameter of the pipe when insulated. Sleeves in bearing and masonry walls shall be made of standard weight steel pipe.

C. Sleeves for pipes passing through non-fire rated floors: 18 gage galvanized steel.

D. Sleeves for pipes passing through non-fire rated beams, walls, footings, and potentially wet floors: Steel pipe or 18 gage galvanized steel.

E. Sleeves for rectangular ductwork: Galvanized steel and framing as shown on details.

F. Firestopping for non-plastic piping, ductwork shall be 3M, Dow, Corning fire caulk/packing or accepted equivalent. Install steel angles around duct penetrations. Refer to Section 07 8400. All fire stopping furnished by all contractors on the project shall have the same manufacturer.

G. All sleeves shall be properly installed and securely cemented in place. Where pipes pass through waterproofed floor or walls, design of sleeves shall be such that the waterproofing can be properly flashed around the sleeves, and of such height that the water will be restrained from entering sleeves and dripping to any finished areas below.

H. Where pipes pass through fire resisting portions of the structure, the annular space between the sleeve and the pipe shall be filled with an approved fireproof material.

1.26 ESCUTCHEONS:

A. All exposed pipes, except as otherwise described, passing through walls, floors, ceilings, etc. in finished spaces, shall be provided with solid pattern heavy ceiling, floor or wall escutcheons with set screw. Escutcheons and plates shall be of steel or malleable iron with prime coat ready for painting. Escutcheons will not be provided where sleeves intentionally extend above finished floor.

1.27 ACCESS DOORS AND PANELS:

A. All ceiling and wall access panels required shall be furnished by this Contractor and set by the General Contractor. The location of these access panels must be approved by the Architect prior to their installation. The Contractor shall furnish an access panel where fire dampers, valves, specialties, junction boxes, and other serviceable items are installed behind plaster, tile, or similar type non-removable surfaces.

B. Panels shall be of suitable size and construction for each specific location. Doors shall be flush and shall open 175 degrees on concealed hinges. All assemblies shall be rustproof and exposed finished edges and surfaces shall be prime-coated with rust inhibitive paint. Doors to be installed in ceilings shall be with screw driver operated cam locks. Doors for wall installation shall have master-keyed cylinder locks. Doors shall be Milcor, or equal, as follows:

1. Construction Milcor Model

    a. Masonry Style M
    b. Plaster Style K

1.28 CUTTING AND PATCHING:

A. Each Contractor shall give the General Contractor complete information as to size of openings to be provided by the General Contractor in new floors, and walls, etc., so that such openings may be provided as the project progresses.

B. If openings are omitted or are incorrect through failure of Mechanical Contractors to follow these instructions, the respective Contractors shall, at their own expense, engage the trade which originally installed the work, to cut and patch to the satisfaction of the Architect.

C. All cutting and patching of every nature required in connection with these Contracts shall be done by each Contractor with mechanics experience in their respective lines of work. All patching shall match adjacent finishes.

D. All cutting in the building shall be done with great care so as not to leave an unsightly surface which may not be concealed by plates, escutcheons, or other normal concealing construction. If such unsightly conditions occur through the fault of the Contractor, he shall be required at his own expense, to engage the General Contractor to replace the damaged materials with new materials.

E. Cutting and patching of the existing building shall be done by this Contractor. All holes cut shall be in a manner approved by the Architect and all patching shall be done so as to match the existing construction and finish. The Contractor shall patch all openings left in present walls, floors and ceilings when ductwork, piping and other materials are removed.

F. Where it becomes necessary to cut out any portions of walls, floors, ceilings, roof or other portions of the building for the installation of work as may be required to perform and complete the work under this Contract, the Contractor shall do all necessary cutting and fitting, shall remove all excess material, and shall replace all work damaged so as to leave the entire premises in a finished condition.

G. No cutting shall be done which may in any way affect the building structurally or architecturally. Any damage incident to cutting or other causes in the performance of this Contract shall be made good by replacement or repairs to the Owner's satisfaction. Cutting shall be done only with the prior approval of the Architect.

H. Patches in fire rated walls, ceilings and floors shall maintain the fire rating of these barriers by the use of approved materials including special fire rated sealing compounds or material identical to the barrier materials. Refer to the Architectural Specifications for approved methods and materials.

I. Contractor shall seal all ductwork and piping penetrations through walls and floors even if not fire rated.

1.29 PAINTING:

A. Provide corrosion inhibiting prime coating on all ferrous materials. Comply with Division 9 of the specifications

B. All exposed piping, iron work, and equipment installed in the mechanical equipment rooms under this contract shall be painted 1 prime coat and 2 coats of best quality oil paint of color as selected by the Architect.

C. Unless specifically noted, insulation and galvanized piping in ceiling cavity area shall not be painted.

D. All grilles, louvers, etc. unless otherwise indicated shall be either furnished in or painted in a color selected by the Architect. When requested by the Architect, the equipment shall be finished with a prime coat and then professionally painted in the field in a color selected by the Owner. The Contractor shall assume responsibility for all costs involved.

E. Note that all exposed ductwork and exposed piping systems shall be painted by the G.C. See Division 9 of the specifications for requirements. Ductwork or piping in rooms without continuous ceilings shall be considered exposed.

1.30 TEMPORARY HEAT:

A. Requirements for providing temporary heat are stated in the General Conditions of the Specifications. New HVAC equipment furnished under this Contract may be used for temporary heat provided all of the following conditions are met:

1. The HVAC equipment is installed as part of the permanent HVAC systems as indicated on the Drawings.
2. The Contractor unconditionally extends the manufacturer's warranty one year from the date of final acceptance by the Owner.
3. Air Handling systems, including air handlers, fan-powered boxes, etc. and duct distribution systems are not to be utilized for temporary heat until interior construction is substantially complete as determined by the Engineer. Obtain approval in writing.
4. The manufacturers of units with compressors extend the 5 year compressor warranty to start from the date of final acceptance by the owner.
5. All energy recovery wheels must be removed from the units utilized for temporary conditioning, sealed and stored by the Contractor. They shall be reinstalled by the Contractor at final acceptance.

1.31 CLEANING OF SYSTEMS:

A. The Contractors shall thoroughly clean all pipe and ductwork systems to remove all grease, oil scale, core, sand and other foreign material after tests have been made and before the building is turned over to the Owner. Flush and treat all systems in each phase as required to meet phasing requirements. See Section 23 2500.

B. All strainers shall be opened and cleaned thoroughly.

C. The interior of all air handling equipment, ductwork and all filters shall be cleaned thoroughly before the building is accepted by the Owner. Refer to Section 23 3100.

D. Should the Contractor put any substance into any system to aid in the cleaning of it, all trace of such material shall be removed before the system is considered clean. All such substances, if used, shall be free from any acid that will set or injure valve seats in any way.

E. Wash all fixtures with soap and water, remove labels and protective covering and clean all grease and cutting from plates or polished piping and trim.

F. Where damage to finish, furnishing or parts of the building results from pipe stoppage or from failure to clear and flush piping systems properly, the Contractor shall at his own expense, employ qualified skilled labor to make repairs.

G. After all tests have been made and the system proven satisfactory to the Architect, the Contractor shall go over the entire project, clean all equipment and material installed by him, and leave in a clean and working condition.

1.32 INSTRUCTION TO EMPLOYEES:

A. At the completion of the work, and before final acceptance of the building by the Owner, each Contractor, together with the representatives of the manufacturers of the equipment installed by the Contractor, shall instruct the designated employees of the Owner in the care, adjustment, maintenance and operation of equipment installed by him.

B. Three copies of factory installation and maintenance schedules shall be furnished for each piece of equipment. Acceptance of materials and equipment is conditional upon receipts of maintenance manuals.

C. A representative of the manufacturer of each piece of equipment shall inspect his respective pieces of equipment, make final adjustments, and put them in a satisfactory working condition.

1.33 OPERATION AND MAINTENANCE INSTRUCTIONS:

A. Upon the completion of this project, the Contractor shall deliver to the Architect for approval, three copies of an operating and maintenance manual consisting of the items outlined hereinafter.

B. The purpose of this manual is to assist the Owner in routine operation, maintenance, servicing, troubleshooting and procurement of replacement parts. All information in the manual shall be as-built and only material pertinent to the project shall be included.

C. The operating manual shall be considered a part of the final inspection and shall be submitted for review and approval at least 30 days in advance of a request for final inspection. The manual shall include:

1. A copy of all final corrected equipment submittals, control diagrams, descriptive brochures, and a list of all parts of each piece of mechanical and electrical equipment which has been furnished and installed.

D. Complete and detailed typewritten operating and maintenance instructions for all major operating equipment. The operating and start-up instructions shall be written in a concise, step by step manner. Maintenance instructions shall include such things as periodic checks, adjustments and troubleshooting techniques. Specifications for lubricants and other required fluids shall be included.

E. A listing of all items of mechanical and electrical equipment, a compilation of the nameplate data for this same equipment, the name, address and telephone number of the nearest service organization.

1. Copies of all A.S.M.E. pressure vessel certifications, state approved tank permits, complete additional valve tag schedules, all electrical inspection permits and all additional mechanical and electrical permits required for occupancy by the Owner.
2. All of the materials shall be indexed by specification section, arranged categorically and be bound in a rigid, plastic covered, three ring binder.

1.34 GUARANTEE:

A. Each Contractor shall unconditionally guarantee in writing all materials, equipment, and workmanship for a period of one year from date of final acceptance. The Contractor shall provide free service including parts replacement for all equipment involved in his Contract during this guarantee period.

B. The guarantee shall include restoration to its original condition of all adjacent work that must be disturbed in fulfilling this guarantee.

C. All such repairs and/or replacements shall be made without delay and at the convenience of the Owner.

D. Refrigeration compressors and heat exchanger circuits shall have a five year guarantee.

E. All warranties shall include parts and labor. Durations of equipment warranties shall begin when the building has been accepted by the Owner.

PART 2 – PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment to permit removal of components and parts which require periodic replacement or maintenance. Arrange pipes, ducts, and equipment to permit access to valves, gauges, starters, motors, doors and access panels.

B. Provide access panels in equipment, ducts, etc. as required for inspection and maintenance.

3.2 PIPING INSTALLATION

A. In general, piping shall be exposed in equipment rooms, and concealed in all finished rooms. Where piping is exposed, it shall be run so as to allow maximum headroom consistent with proper pitch. No piping or ductwork shall cross below the head of any window or door.

B. Exposed piping, ducts, conduits, and/or appurtenances indicated on the inside of buildings, shall be installed parallel to the building lines. All piping shall be kept as close as possible to the ceilings, walls, and columns, to take up the minimum amount of space.

C. All work shall be arranged and installed as high as possible to prevent obstruction of window areas, and to give adequate clearance and access for operation and maintenance.

3.3 SLEEVES

A. Where pipes pass through concrete or masonry walls or concrete floors, they shall be protected through the full depth of the construction with galvanized sleeves; same to be at least one size larger than the pipe plus insulation.

B. Where sleeves occur in concrete floors, the top of sleeve shall be 2" above the finished floor line, and the end shall be filed to a smooth round finish.

C. This Contractor shall supply all pipe sleeves and shall inform general contractor of exact sleeve locations in time for their incorporation onto the concrete forms or masonry work.

D. Any cutting and patching in masonry or concrete made necessary by failure to adequate coordinate with the general contractor shall be done by the general contractor at the expense of this contractor.

E. The space between pipes and sleeves shall be caulked air tight with a non-combustible inorganic material.

3.4 UNIONS

A. Unions shall be provided at all connections to each piece of equipment and on both sides of all automatic valves, and devices which requires removal for maintenance. No unions are to be placed in a location which will be inaccessible after the completion of the project.

B. Unions of copper tubing shall be 200 lbs. SWP brass ground joint.

C. Unions for steel pipe shall be 250 lbs. SWP, malleable iron with brass to iron seat.

3.5 CLEARANCE

A. All piping, including valves and fittings shall be installed to provide the following minimum clearances between the finish coverings, adjacent pipe and/or conduits: 4" between for piping services and 6" between piping services and electrical conduits.

3.6 ESCUTCHEON PLATES

A. All piping passing through walls, ceilings, and floors shall be provided with escutcheon plates securely fastened in place. Where installed on piping in finished areas they shall be chrome plated.

3.7 ACCESS PANELS

A. Removable panels shall be located so as to provide easy access to all concealed plumbing accessories that may require adjustments or maintenance, such as valves, water hammer arresters, traps, strainers, cleanouts or others.

B. Access panels in finished wall or ceiling surfaces shall be furnished by this Contractor for installation by the General Contractor.

C. This Contractor shall pay for any work made necessary by his failure to inform other trades of access panel locations.

3.8 APPLICATIONS OF INSULATION AND COVERING

A. No covering shall be installed by the Contractor until the piping and ducts have been approved by the Architect/Engineer/Construction/Owner.

3.9 INSERTS

A. Except as noted, provide box type inserts for all hangers and supports intended to suspend piping or light weight equipment from new concrete construction. Fasten all inserts of the form work before concrete is poured. Inserts to be Grinnell Figure No. 282 or Figure No. 279 depending upon the maximum load to be carried.

B. No toggle bolts, expansion screw anchors or similar imbedded hanger supports shall be used in new construction.

3.10 CHASES AND OPENINGS IN FLOORS AND WALLS

A. It shall be the duty of the Contractor requiring chases, openings or the placement of any sleeves, anchors, and supports required for his work, whether or not shown on the drawings, to advice the General Contractor accordingly, prior to or at the time of pouring concrete slabs, beams or the building of walls, etc. He shall furnish all such sleeves, anchors, and supports in place, and all necessary information for the proper location of said chases or openings. Show all information on the coordination drawings.

B. If a contractor shall fail to observe and comply with those requirements, he shall cut, at his own expense, after receiving the consent of the Architect, such chases or opening as may be necessary and proper, providing and building in place all lintels required by these openings, doing the necessary patching and rebuilding of the work required under the direction of the General Contractor and he hall be responsible for all loss or delay resulting therefrom.

3.11 EQUIPMENT BASES AND SUPPORTS:

A. Provide housekeeping pads of concrete, minimum 4” thick and extending 4” beyond supported equipment.

B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of steel members. Brace and fasten and flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed.

END OF SECTION 23.0501

SECTION 23.0513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Single phase electric motors.

B. Three phase electric motors.

1.2 RELATED SECTIONS

A. Section 23 0514 - Variable Frequency Drives.

1.3 REFERENCES

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; American Bearing Manufacturers Association, Inc.; 1990 (Reapproved 2000).

B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; Institute of Electrical and Electronic Engineers; 2004.

C. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2009, Revision 1 - 2010.

D. ASHRAE (American Society of Heating, Refrigeration, and Air-Conditioning Engineers) Standard 90.1 Energy Standard for Buildings Except Low-Rise Residential Buildings.

E. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.

C. Test Reports: Indicate test results verifying nominal efficiency and power factor for three phase motors larger than 1/2 horsepower.

D. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

E. Operation Data: Include instructions for safe operating procedures.

F. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.5 QUALITY ASSURANCE

A. Conform to NFPA 70.

B. Motors shall comply with ASHRAE Standard 90.1 Energy Standard for Buildings Except Low-Rise Residential Buildings current edition.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.7 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Century

B. Baldor

C. Lincoln Motors

D. A. O. Smith Electrical Products Company

2.2 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Construction:

1. TEFC type except where specifically noted otherwise.
2. Design for continuous operation in 40 degrees C environment.
3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
4. All motors shall be high efficiency type.

B. Provide motors with phase loss protection.

C. Motors for use with VFD's shall be designed and approved by the manufacturer for use with VFD's.

D. Mechanical Contractor shall provide all motors that are required. Each motor shall be the correct service type and have a horsepower rating that is adequate for the device it is intended to drive. Motors shall not exceed their full load rating, including the service factor rating, whenever the driven equipment is operating at the specified capacity under normal operating conditions.

E. Insulation shall be Class B. Motors shall be dripproof in dry, non-hazardous locations, weather protected where exposed to the weather or dampness, and totally enclosed, fan cooled where specified. Dripproof and totally enclosed fan cooled motors, fractional and integral horsepower, shall have service factor ratings of 1.15 and 1.0 respectively. Fractional horsepower motors shall have sealed, permanently lubricated, ball bearings unless sleeve bearings are standard with a manufacture of equipment which utilized direct driven fans. Integral horsepower motors shall have ball bearings with grease zerk fittings and drain ports. All motors shall be rated for continuous duty. Maximum temperature rise shall not exceed 40 degrees C. for dripproof frame motors and 55 degrees C. for totally enclosed motors in a 40 degree C. ambient condition. Motors shall be suitable for the electrical service specified, scheduled or shown.

F. Motors shall have been tested and approved by the Underwriters' Laboratories, Inc. Motors shall be manufactured and classified in accordance with the current NEMA Standard Publication No. Mg 1 entitled "Motors and Generators."

G. Motors shall be dynamically balanced and tested at the factory before shipment. They shall be relatively quiet while running. Connections to direct driven devices shall be made with a flexible coupling. Motors for V-belt drive service shall be furnished with a steel base and a screw device for adjusting belt tension.

H. Motors shall be mounted so that they are readily accessible for maintenance. Motor terminal boxes shall be accessible. Covers shall not be blocked by other equipment. Watertight terminal boxes shall be provided on those motors in wet locations or where they are exposed to the weather. Motor mounting arrangement shall be such that the motor mounting bolts are accessible in order to facilitate its removal.

I. Explosion-Proof Motors: UL approved and labelled for hazard classification, with over temperature protection.

J. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

K. Wiring Terminations:

1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.3 ELECTRICAL CONNECTIONS

A. All electrical connections shall be made by the Electrical Contractor. Motors and controls for equipment furnished by each Contractor shall be furnished and set by the Contractor furnishing the equipment. Where electrical work is specifically indicated to be performed by the Plumbing, Fire Protection or Heating Contractor, this Contractor shall perform the work in conformance with Electrical Specifications for this project.

2.4 MOTOR CONTROLLERS

A. Mechanical Contractor shall provide motor controllers. The items shall be products of one manufacturer, Allen-Bradley, Square D, General Electric or Westinghouse, and shall meet latest N.E.M.A. and IEEE Specifications. Starters and contactors shall be horsepower rated. Starters shall include the proper size heater elements

B. Magnetic starters shall be provided with "On-Off-Auto" switches on the starter.

C. Unless otherwise noted, control and pilot devices such as electric thermostats, alternators, float controls, aquastats, etc., shall be furnished and installed by the Mechanical Contractor. Each device shall be provided with all auxiliary features and accessories which may be required for correct operation of the associated equipment.

D. Magnetic starters shall be provided with start-stop pushbuttons on the starters unless remote control pushbuttons or other methods of starting are specified elsewhere.

E. Unless otherwise noted elsewhere, all magnetic motor starters controlled with a remote pilot device shall contain a control circuit transformer, as an integral part of the controller, providing control power at a maximum 120 volts for the pilot device. The exact control circuit voltage shall be coordinated with the ATC supplier prior to the purchase of any motor controllers.

F. Starters and protective devices which are provided as an integral part of the equipment furnished under the Mechanical Contracts, shall be supplied.

G. For use in manual starting of fractional horsepower motors up to but not including 1/2 horsepower, the Mechanical Contractor shall furnish a thermal manual toggle switch type starter with pilot light specifically designed for this purpose. Each starter shall be provided with proper size heater element for the motor to be controlled. Heater elements shall be readily removable and interchangeable. Starters shall be arranged for flush or surface mounting as indicated or as required.

H. Controllers and wiring diagrams shall be delivered to the Electrical Contractor.

2.5 MOTOR DISCONNECTS:

A. Unless otherwise noted, motors located out of sight of their respective electric panels shall be provided with disconnect switches at the motors by the Mechanical Contractor.

B. All exhaust and supply fans on the roof shall be provided with disconnecting means at the motors as an integral part of the equipment.

2.6 ENCLOSURES:

A. Motor controllers and disconnects shall be provided with standard approved enclosures to suit the locations in which they are installed and the conditions under which they are to operate.

2.7 MOTOR CONTROL WIRING:

A. The Electrical Contractor shall run the power wiring system from the various supply panels indicated, to the motors and motor controllers and shall make final connections unless otherwise noted on the Drawings. The Mechanical Contractors shall run all control wiring from the motor controllers to the pilot devices.

B. Starters, and protective control devices which are provided as integral part of the motors or motor-operated equipment shall be prewired at the factory.

C. After final connections are completed, the Mechanical Contractor shall test each motor for proper rotation. Before applying current to the motor, the Mechanical Contractor shall check the motor for alignment, oil, etc. The Mechanical Contractor shall make any necessary adjustments to the starter and control equipment for proper starting and overload protection.

END OF SECTION 23.0513

SECTION 23.0514 - VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The General Provisions of the Contract, including General and Supplementary Conditions apply to the Work of this Section.

B. Section 23 0993 - HVAC Control Sequence.

C. Section 23 0923 – Direct Digital Control (DDC) System

1.2 DESCRIPTION OF WORK:

A. Extent of work is hereby defined as the furnishing and installation of variable frequency drives of the types and sizes as indicated on the Drawings and as specified herein.

1.3 QUALITY ASSURANCE:

A. Manufacturers: Subject to compliance with the requirements of this section, provide variable frequency drives as manufactured by Square D, Cutler Hammer, Danfoss, or ABB.

B. NFPA Compliance: Comply with applicable provisions of ANSI/NFPA 70 "National Electric Code", pertaining to the construction and installation of electrically operated components.

C. NEMA Compliance: Comply with applicable provisions of NEMA Standards pertaining to motor starters, control panels, and wiring devices.

D. UL Compliance: Provide electrical components which have been tested, approved, and labeled by Underwriters Laboratories.

1.4 SUBMITTALS:

A. Section 01 3000 contains definitions, requirements and procedures for the following submittals:

1. Shop Drawings
2. Guarantees
3. Product Data

1.5 WARRANTY:

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 - PRODUCTS

2.1 ADJUSTABLE FREQUENCY DRIVES:

A. General: Provide variable frequency drives (VFD) for equipment as scheduled and as shown on the drawings to vary the speed of the three phase AC motors to proportionately control the air or water flow of each system. The VFD shall utilize a 16-bit microprocessor for sine-coded pulse width modulation of AC induction or synchronous motors.

B. Input Power: The VFD shall accept 460V/3P/60Hz input voltage within a ±10% variation.

C. Output Power: The VFD output power shall vary frequency to the motor from 0 to 400 Hz with resultant motor speed varying at the motor nameplate rated speed, with output voltage variation from zero to motor rated voltage for optimum volts per hertz (V/Hz) ratio for fan loads. Output currents shall be rated 125% of motor full load amps for 1 minute based upon VFD's variable torque rating. The output shall be a voltage source type generating a sine coded PWM waveform utilizing an asynchronous carrier frequency up to 15000 Hz. The carrier frequency shall be adjustable to minimize harmonically induced noise or vibration.

D. Power Structure: The VFD power input stage shall convert three phase AC line power to a fixed DC bus voltage by using a full-wave diode rectifier with three phase protection. Power factor shall be.98 or corrected with capacitors. The VFD shall have power component monitoring/protection, short circuit power protection, and capacitive filtering of DC power. Switching transistors shall convert DC power to sine coded pulse width modulation voltage for motor control. Current transformers shall monitor output current and be used by the microprocessor for: thermal overload protection, three phase current limit, ground fault and short circuit protection, and motor restart with speed search. Insulated Gate Bipolar Transistors shall be utilized for a fixed carrier frequency of 15,000 Hz.

E. Operation and Protective Functions: The VFD shall be capable of performing the following operational functions in addition to providing built-in protective features:

1. DC injection braking with adjustable start frequency, current limit and time duration to provide braking before fan start-up.
2. Programmable critical frequency interruptive to lock-out up to 3 frequency ranges, 0 to 10 Hz, to avoid motor operation at resonant speeds.
3. Speed search to restart motor while fan is still rotating.
4. Reference speed loss detection to continue fan operation if the reference frequency is interrupted. Motor shall be operated at 80% of last reference valve.
5. Programmable auto restart and stall prevention to adjust output frequency to avoid overload or overcurrent conditions.
6. Power-loss ride through to automatically restart the motor after a power interruption less than two seconds duration.

7. Reverse rotation prevention.

F. Control Terminal Functions: A control terminal strip shall be provided to accept the following external control commands:

1. Forward Run/Stop to initiate or stop VFD operation.
2. Speed Reference Input to accept an instrument follower signal of either a) 0 to 10 VDC, b) 4 to 20mA, or c) 1 to 5 VDC as determined by the Automatic Temperature Control Contractor.

G. Multi-function output contacts programmable for any of the following indications:

1. Run mode
2. Zero speed detect
3. Overtorque detect
4. Coast to stop detect
5. Run reference mode
6. Speed reference mode
7. Speed synchronization
8. Output frequency detect
9. Low voltage detect
10. Operation ready
11. Speed reference loss detect
12. Braking resistor fault
13. Drive fault
14. Output fault relay contact to indicate AFD diagnostic fault detection.
15. Terminal for HOA switching.
16. Input terminal to shut down motor operation on smoke detection signal or other external fault signals.
17. Analog output signal, 0 to 10 VDC, proportional to output frequency or output covered.

H. Local Operator Control: The VFD shall have a front mounted sealed touch-pad operator to include:

1. Local run/stop keys
2. Local speed command
3. Reset push button
4. Digital output frequency meter and speed reference meter which both can be reprogrammed for other speed related indications, including RPM, CFM, FPM, etc.
5. Digital voltmeter.
6. Digital kilowattmeter.
7. Digital ammeter.
8. Input and output terminal status indication.
9. Ability to program various control functions without necessity of stopping drive while in Run mode, including but not limited to the following:
    a. Acceleration and deceleration
    b. Frequency command bias and gain
    c. Torque compensation
    d. Slip compensation

e. Energy savings gain
f. Multi-step speed references
g. Digital diagnostic indication and protection for:

1) DC bus undervoltage
2) DC bus over voltage
3) Load over torque
4) Fuse blown
5) Motor overload
6) AFD overload
7) Heatsink over temperature
8) Instantaneous over current
9) Operator error
10) Central processor fault
11) External fault
12) Dynamic braking fault

I. VFD Adjustments: The microprocessor control AFD logic shall include the following adjustments:

1. Maximum output frequency - 0 to 400 Hz.
2. Minimum output frequency - 0 to 400 Hz.
3. Acceleration time -.1 to 6000 seconds.
4. Deceleration time -.1 to 6000 seconds.
5. Current limit - 0 to 170%.
6. 15V/Hz pre-set selection patterns.
7. Capability to program a totally customized V/Hz pattern.
8. Auto speed reference (instrument follower) input adjustable for bias and gain.
9. Stall prevention accomplished by reducing output voltage and frequency during momentary overload. When overload clears, drive will automatically resume normal operation.
10. Adjustable torque and/or current limit.
11. Ramp to stop or coast to stop selection.
12. Capability to set upper and lower frequency limits independent of min and max V/Hz frequency patterns.
13. Linear or S-curve function for soft start.
14. Two independent, selectable accel/decel ramp functions.
15. A minimum of 4 programmable multi-function inputs.
16. External start/stop shall be programmable for either 2 wire or 3 wire control. 3 wire option should not require a holding contact.
17. There shall be a programmable lock out code available to prevent operator access to parameter setting.
18. A selectable/adjustable energy saving gain shall be available that can be activated during frequency command synchronization.
19. Minimum of 9 preset speeds.
20. Up/down frequency setting.

J. Bypass: The VFD shall have a bypass to allow operating the connected motor in the event of VFD failure.

K. Systems Integration: VFD manufacturer shall provide BACNET network card to interface with BAS system. Verify protocol with BAS manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install all equipment listed in this section in accordance with the manufacturer's written instructions and wiring diagrams or as directed by factory service personnel.

3.2 START-UP:

A. Do not place VFD's into start-up until mechanical and electrical systems are fully operational including installation of terminal equipment and automatic temperature controls.

B. The VFD manufacturer's factory trained service personnel shall perform all programming and start-up procedures.

C. Instruct Owner on operation of unit. Provide minimum 4 hours instruction.

3.3 TESTING AND ADJUSTING:

A. The manufacturer’s factory trained service personnel shall test each unit through the full range of operation including checking all input/output signals, and fault conditions.

B. Manufacturer shall validate system is fully functional and operation perfectly upon completion of testing and adjusting.

3.4 SCHEDULE:

A. Energy Recovery Units:

1. Provide variable frequency drives for the supply fan, exhaust fan, and energy recovery wheel (by the unit manufacturer).

B. Rooftop Units:

1. Provide variable frequency drives for the supply fan (by the unit manufacturer).

C. Pumps:

1. Provide variable frequency drives for all hot water pumps.

D. Exhaust fans:

1. Provide variable frequency drives for any exhaust fan as noted on the fan schedule.

END OF SECTION 23.0514

SECTION 23.0516 - EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flexible pipe connectors.

B. Expansion joints and compensators.

C. Pipe loops, offsets, and swing joints.

1.2 RELATED REQUIREMENTS

A. Section 23 2113 - Hydronic Piping.

1.3 PERFORMANCE REQUIREMENTS

A. Provide structural work and equipment required to control expansion and contraction of piping. Verify that anchors, guides, and expansion joints provided adequately protect systems.

B. Expansion Calculations:

1. Installation Temperature: 50 deg F
2. Hot water heating: 200 deg F
3. Safety factor: 30%

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data:

1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

C. Design Data: Indicate selection calculations.

D. Manufacturer's Instructions: Indicate manufacturer's installation instructions, special procedures, and external controls.

E. Project Record Documents: Record installed locations of flexible pipe connectors, expansion joints, anchors, and guides.

F. Maintenance Data: Include adjustment instructions.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Packing for Packed Expansion Joints: One set for each joint.

1.5 REGULATORY REQUIREMENTS

A. Conform to UL requirements.

PART 2 PRODUCTS

2.1 FLEXIBLE PIPE CONNECTORS - STEEL PIPING

A. Manufacturers:

1. Metraflex Company.
2. Mason Industries, Inc..
3. Flexonics.

B. Inner Hose: For pipes over 2" size, Carbon Steel. Bronze for pipes 2" and smaller.

C. Exterior Sleeve: Single braided, stainless steel.

D. Pressure Rating: 125 psi and 450 degrees F.

E. Joint: As specified for pipe joints.

F. Size: Use pipe sized units.

G. Maximum offset: 3/4 inch on each side of installed center line.

2.2 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

A. Manufacturer:

1. Metraflex Company.
2. Mason Industries, Inc..
3. Flexonics.

B. Inner Hose: Bronze.

C. Exterior Sleeve: Braided bronze.

D. Pressure Rating: 125 psi and 450 degrees F.

E. Joint: As specified for pipe joints.

F. Size: Use pipe sized units.

G. Maximum offset: 3/4 inch on each side of installed center line.

2.3 EXPANSION LOOPS

A. Manufacturer:

1. Metraflex Company.
2. Mason Industries, Inc..
3. Flexonics.

B. Metraloop with two sections of hose and brand, two 90 degree elbows and 180 degree return.

C. Install within 4 pipe diameters of alignment guide.

D. Pipe material shall match service pipe.

2.4 GROOVED PIPING EXPANSION JOINTS

A. Manufacturer:

1. Victaulic; Style 155 Expansion Joint
2. Anvil; 7240 Expansion Joint.

B. Housing: Ductile iron conforming to ASTM A536, Grade 65-45-12.

C. Gasket: Grade “E” EPDM.

2.5 ACCESSORIES

A. Pipe Alignment Guides:

1. Manufacturers:
2. Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3 inches travel.

B. Swivel Joints:

1. Fabricated steel body, double ball bearing race, field lubricated, with rubber (Buna-N) o-ring seals.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Construct spool pieces to exact size of flexible connection for future insertion.

C. Install in accordance with EJMA (Expansion Joint Manufacturers Association) Standards.

D. Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.

E. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

F. Anchor pipe to building structure where indicated. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.

G. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where indicated.

H. Provide expansion loops, pipe guides and anchors as indicated on the drawings if welded or threaded piping is used.

I. Provide grooved piping expansion joints if grooved piping and couplings are used. Consult grooved piping/coupling manufacturer's engineering services for quantity and locations of expansion joints.

END OF SECTION 23.0516

SECTION 23.0519 - METERS AND GAGES FOR HVAC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pressure gages and pressure gage taps.

B. Thermometers and thermometer wells.

1.2 RELATED REQUIREMENTS

A. Section 23 2113 - Hydronic Piping.

1.3 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; The American Society of Mechanical Engineers; 2013.

B. ASTM E1 - Standard Specification for ASTM Thermometers; 2013.

C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2007.

D. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop drawings: Provide manufacturer's cut sheets for all devices.

C. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements for additional provisions.

1.5 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.1 PRESSURE GAGES

A. Manufacturers:

1. Dwyer Instruments, Inc
2. Moeller Instrument Co.
3. Omega Engineering, Inc.
4. Weksler

B. Pressure Gages: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.

1. Case: Steel with brass bourdon tube.
2. Size: 4-1/2 inch diameter.
3. Mid-Scale Accuracy: One percent.
4. Scale: Psi.

2.2 PRESSURE GAGE TAPPINGS

A. Gage Cock: Tee or lever handle, brass for maximum 150 psi.

2.3 STEM TYPE THERMOMETERS

A. Manufacturers:

1. Dwyer Instruments, Inc.
2. Omega Engineering, Inc.
3. Weksler Glass Thermometer Corp.

B. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.

1. Size: 9 inch scale.
2. Window: Clear Lexan.
3. Stem: 3/4 inch NPT brass.
4. Accuracy: 2 percent, per ASTM E77.

5. Calibration: Degrees F.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide one pressure gage per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gage.

C. Install pressure gages with pulsation dampers. Provide gage cock to isolate each gage. Extend nipples to allow clearance from insulation.

D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

E. Provide instruments with scale ranges selected according to service with largest appropriate scale.

1. 40 F to 240 F for hot water thermometers.

F. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

G. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

END OF SECTION 23.0519

SECTION 23.0549 – VIBRATION ISOLATION

PART 1 GENERAL

1.1 SUMMARY:

A. The extent of vibration isolation and seismic restraints work is indicated by Drawings and schedules and by requirements of this Section.

B. The Contractor shall employ the services of a licensed Professional Engineer registered in the State of Pennsylvania to design, submit, and supervise the installation of seismic restraining products applicable to all equipment, ductwork, and piping systems installed by the Contractor.

C. The types of vibration isolation and seismic restraint is specified in this Section include the following:

1. Support isolation for motor driven Mechanical Equipment.
2. Support isolation and restraints for ductwork and ductwork riser.
3. Support isolation for piping and piping risers.
4. Flexible connections for piping at Equipment.
5. Flexible ductwork connections.

1.2 SUBMITTALS:

A. The Manufacturer of vibration isolation and seismic control products shall submit the following data clearly marked on the submittal drawing. Each piece of isolated equipment shall be clearly identified, as well as the quantity and type of vibration isolators.

1. Weight and center of gravity of each piece of isolation equipment, and RPM of each piece of rotating isolated equipment. When equipment center of gravity is not available, assumed locations for center of gravity shall be identified in submittals.
2. Calculated static load on each isolator.
3. Calculated deflection for each piece of isolated equipment.
4. Calculated seismic loads for each restraint including horizontal and vertical forces and overturning moments.

B. Submittals for mountings and hangers incorporating springs shall include spring diameters, rated deflections, spring free height, solid spring height and spring color code.

C. Submittals for bases shall clearly identify locations for all mountings, as well as all locations for attachment points of the equipment to be mounting base. Installation instructions shall be included.

D. Submittals shall include seismic calculations signed and checked by qualified licensed Engineers in the employ of the Manufacturer of the vibration isolators. Catalog cut sheets shall be included for each type of mounting used on equipment being isolated.

1. Manufacturer's certification of components seismic acceleration operational capacity and attachment.
2. Submit detailed seismic drawings, drawn to the scale indicated, for each of the following installations. All seismic drawings shall be based on the Architectural and Structural Contract Drawings. All seismic drawings shall bear the stamp of a Professional Engineer licensed in the state of the Project site:
3. Mechanical Equipment rooms depicting size and location of concrete housekeeping pads and the location and type of seismic restraints. Minimum Scale: 1/4"=1'-0".
4. Piping Plans depicting location and type of seismic restraints. Minimum Scale: 1/8"=1'-0".
5. Concrete pad details depicting location and size of reinforcing, doweling, and anchor bolts for each specific piece of mechanical equipment. Minimum Scale: 1/2"=1'-0".
6. Suspended mechanical equipment and roof mounted mechanical equipment depicting restraint locations, types, and methods of attachment. Minimum Scale: 1/8"=1'-0".
7. Miscellaneous Attachment Details depicting size, locations, and types of attachment (i.e., bolts, welds, anchors, cables) for securing equipment to seismic mountings and for securing seismic mountings to the building structure.

E. Submit a seismic design errors and omissions insurance certificate. (Manufacturers product liability insurance certificates are not acceptable.

1.3 QUALITY ASSURANCE:

A. Product Qualification: Provide each type of vibration isolation unit produced by a specialized manufacturer, with not less than 5 years successful experience in the production of units similar to those for the project.

1. Except as otherwise indicated obtain support isolation units from a single manufacturer.
2. Engage the manufacturer to provide technical supervision of the installation of support isolation units produced by him, and of associated inertia bases.

B. Manufacturer: Provide vibration isolation and seismic mounting units manufactured by the following:

1. Amber/Booth
2. Consolidated Kinetics Corp.
3. Vibration Mountings and Controls, Inc./Korfund Dynamics
4. Mason Industries
5. Vibration Eliminator Co.
6. BRD Noise and Vibration Control, Inc.

C. After installation is complete and while the system is operating, the vibration isolation and seismic control Manufacturer and/or his qualified Representative shall conduct an inspection of the installation with the Contractor. The Representative will submit a written inspection report detailing any discrepancies, the Representative shall submit a report so stating. If there are discrepancies, the report shall detail corrective work to be done.

1.4 DESIGN - VIBRATION ISOLATION SYSTEMS:

A. Vibration isolators shall be selected based on known or estimated operating weight distributions of the isolated equipment, with the quantity and location as shown on the components drawings. Isolator type shall be tabulated for each isolated piece of equipment.

B. Isolators shall have either known non-deflected heights of spring element or calibration markings so that, after adjustment, when carrying their load, the deflection under load can be verified to determine if the load is within the proper range of the isolator and if the correct degree of vibration isolation is being provided.

C. Isolators shall function in the linear portion of the load versus deflection curve. Theoretical vertical natural frequency shall not differ from the design objectives by more than +10%.

D. Vibration isolation available internal to the equipment shall not be considered equivalent, and may only be used where it can be shown not to compromise the strength or performance of the entire system.

E. Unless otherwise specified, all isolated equipment and all piping and ductwork shall be seismically restrained in accordance with requirements contained herein. All unisolated mechanical equipment shall be adequately secured to the structure.

F. Unless the equipment incorporates unit construction using an integral unit frame or is specified otherwise, each item of mechanical equipment, along with its drive unit, shall be mounted on a rigid steel or steel and concrete base. The equipment, including the base, shall be mounted on, or suspended from, vibration isolators to prevent the transmission of vibration and mechanically transmitted structureborne sound to the supporting structure.

G. Isolation hangers shall be used for all piping in equipment rooms or for 50 ft. from vibration equipment, whichever is greater. To avoid reducing the effectiveness of equipment isolators, at least three of the first hangers from the equipment should provide the same deflection as the equipment isolators, with a maximum limitation of 2 inch deflection. The remaining hangers shall be spring or combination spring and rubber with a minimum of 0.75 in deflection. To prevent load transfer to the equipment flanges when the piping system is filled, the first three hangers adjacent to the equipment shall be the positioning type (specification type 5). Floor supports for piping in equipment rooms and adjacent to isolated equipment shall use restrained vibration isolators. They should be selected according to the guidelines for hangers.

1.5 DESIGN - SEISMIC RESTRAINTS

A. Internally isolated equipment in lieu of specified isolation and restraint system must include certification by the equipment manufacturer that the internal isolation system meets the specified isolation and system restraint criteria. Equipment resiliently mounted on spring or pad type isolators, except for curb mounted equipment shall be provided with seismic restraints or snubbers. Where required by code, seismic restraints for equipment mounted on vibration isolated curbs shall consist of slack galvanized or stainless steel cables (Type 16), attached to a structurally sound element of the equipment.

B. Each piece of isolated equipment shall receive a minimum of four all-directional restraint/snubbers, located as close to the equipment corners as practical. These shall consist of either restrained isolators or free standing isolators with separate snubbers. All snubbers shall have an impact surface consisting of a high quality elastomer. The elastomer shall be easy to inspect for damage, shall be replaceable and shall be a minimum of 3/4 inch thick.

C. Calculations by the Manufacturer's qualified licensed Engineer substantiating the mounting system, seismic restraints and recommended anchor bolts shall be submitted for approval along with the mechanical drawings. Minimum spacing of anchor bolts, as well as location from edges of structure or concrete, shall be identified.

D. Unless otherwise specified, all equipment piping and ductwork shall be restrained to resist seismic forces. Restraints shall maintain mechanical equipment, piping or ductwork in a captive position. Restraint devices shall be designed and selected to meet seismic requirements as defined in the latest issue of IBC.

E. Seismic restraint shall be required for the following installations:

1. Pumps
2. Roof Mounted Energy Recovery and Rooftop Units
3. Fans
4. In line fans suspended
5. VAV Boxes
6. Heating Hot Water Piping
7. Ductwork

F. The site is classified as follows: Seismic Design Category C, Site Classification C and Importance Factor 1.5 of the 2021 International Building Code. All mechanical components have an Ip (Importance Factor) of 1.5.

G. Anchor bolt calculations, signed by a qualified licensed Engineer, shall be submitted showing adequacy of bolt sizing and type. Calculations shall be furnished for anchors on restraint devices, cables, isolated and rigidly mounted equipment. Calculations shall specify anchor bolt type, embedment, concrete compressive strength, minimum spacing between anchors, and minimum distances of anchors from concrete edges. Concrete anchor locations shall not be near edges, stress joints, or an existing fracture. Embedded bolt locations and spacing shall conform to Table 26-E of 1991 Uniform Building Code. All bolt shall be ASTM A307 or better.

PART 2 - PRODUCTS

2.1 Unless otherwise specified, all hardware shall be stainless steel or zinc plated. Springs with a deflection of up to 2 inches shall be zinc plated, or coated with a polyester epoxy powder. Springs with a rated deflection capability greater than 2 inches may be painted. Zinc plating shall conform to ASTM B633, Class 2 SC2, minimum.

2.2 TYPE 1 MOUNTINGS - DOUBLE DEFLECTION NEOPRENE:

A. Double deflection neoprene mountings shall have a minimum rated static deflection of 0.40 inches. Steel top plate and base plate shall be completely bonded and embedded in oil-resistant elastomer. Mountings shall be molded in color for ease of identification of load capacity, and shall have ribbed neoprene surfaces on top and bottom to provide friction pads for those applications which do not need to be bolted to the floor or to equipment. Bolt holes shall be provided on the bottom plate, and a tapped hole on the top, for applications requiring positive tie down.

B. Mountings may be combined with steel rails for ease of installation, to compensate for overhung components or for equipment which lack sufficient rigidity for point support.

C. Neoprene mountings shall be type RD and steel channel rails type DRB as manufactured by Vibration Mountings and Controls, Inc.

2.3 TYPE 2 MOUNTINGS - FLOOR MOUNTED SPRING ISOLATORS:

A. Free standing spring-type isolators, shall be laterally stable without housing, snubbers, or guides, and shall include a steel reinforced, ribbed neoprene cup (1/4-inch minimum thickness) between the baseplate and the support.

B. Mountings shall have leveling bolts on the top, consisting of an adjusting bolt, cap screw and washer. Mountings shall include a bolt hole in the bottom cup or a two hole rectangular steel baseplate for bolting to the structure. Springs shall not be welded to the baseplate or cup.

C. Spring diameters shall be no less than 0.8 times the compressed height of the spring at rated load. Springs shall also have a minimum additional travel to solid equal to 50% of the rated deflection.

D. Springs shall have a ratio of horizontal stiffness to vertical stiffness of .75 to 1.25.

E. Springs shall be color coded for proper identification of rated load capacity. Springs shall be coated with a polyester epoxy powder. Springs having rated deflection greater than 2 inches may be painted. Hardware shall be stainless steel, or zinc plated.

F. Housed floor isolators shall consist of a telescoping housing containing one or more steel springs as the isolating medium. Isolators shall include resilient inserts to act as upper and lower housing guides, and to prevent metal-to-metal contact providing elastomeric snubbing for side loads. A replaceable neoprene acoustical non-skid pad shall be attached to the bottom of the housing. Mountings shall have built-in leveling bolts and a minimum additional travel to solid equal to 50% of the rated deflection.

G. Free standing Spring-Flex Mountings shall be Series AC, Series ACB, or Series AWHC as manufactured by Vibration Mountings and Controls, Inc. Housed Spring-Flex Mountings shall be Series B, C, or D as manufactured by Vibration Mountings and Controls, Inc.

2.4 TYPE 3 MOUNTINGS - HOUSED SPRINGS WITH LIMIT STOPS:

A. Free standing, laterally stable spring-type isolators. Isolators is the same as described in Specification Type 2, except that it includes a housing to provide vertical limit stops to prevent spring extension during weight changes (e.g., draining of fluid from cooling towers and boilers), or when equipment (such as cooling towers) are exposed to uplift loads such as wind loading.

B. The housing serves as blocking during erection, and shall be located between the equipment and supporting structure. Housing shall be painted or hot dip galvanized. There shall be a minimum clearance of 1/2 inch between the restraining bolts and the housing and spring to prevent interference with spring performance. Limit stops shall be out of contact during normal operation.

C. Mountings shall have an adjusting bolt on the top of the spring compression plate. Neoprene acoustical non skid pads (1/4 inch minimum thickness) shall be attached to the bottom plate.

D. Spring diameters shall be no less than 0.8 times the compressed height of the spring at rated load. Springs shall also have a minimum additional travel to solid equal to 50% of the rated deflection.

E. Springs shall be color coded for proper identification of rated load capacity. Springs shall be coated with a polyester epoxy powder. Springs having rated deflection greater than 2 inches may be painted. Hardware shall be stainless steel or zinc plated. Springs shall not be welded to the cups or housings.

F. Spring-Flex Mountings shall be Series AWR as manufactured by Vibration Mountings and Controls, Inc.

2.5 TYPE 4 MOUNTINGS - SPRING AND RUBBER HANGERS:

A. Spring-Flex hangers shall consist of a steel spring in series with a .2 inch (minimum) deflection neoprene element. Springs shall be color coded, and elastomer element molded in specific colors for proper identification of rated load capacity. The total static deflection at rated load shall be 1.20 inches.

B. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection.

C. Springs shall be coated with a polyester epoxy powder. Hardware shall be stainless steel, or zinc plated. Steel housings shall be painted or galvanized.

D. Spring-Flex hangers shall be series RSH as manufactured by Vibration Mountings and Controls, Inc.

2.6 TYPE 5 MOUNTINGS - SPRING AND RUBBER PRE-POSITIONING HANGERS:

A. Spring-Flex hangers shall consist of color-coded steel spring in series with a neoprene element molded in specific colors for proper identification of rated load capacity. Hanger design shall incorporate a means for supporting the suspended equipment or piping at a fixed elevation during installation regardless of load changes as well as a means for transferring the load to the spring.

B. Springs shall be coated with a polyester epoxy powder. Hardware shall be stainless steel, or zinc plated. Steel housings shall be painted or galvanized.

C. Spring-Flex hangers shall be series RSHP positioning hangers as manufactured by Vibration Mountings and Controls, Inc.

2.7 TYPE 6 MOUNTINGS - SPRING AND RUBBER HANGERS WITH 30 DEGREE MISALIGNMENT CAPABILITY:

A. Spring-Flex hangers shall consist of a color coded steel spring in series with a neoprene element molded in specific colors for proper identification of rated load capacity. Spring diameters and hanger box lower hole sizes shall be of sufficient size to permit the hanger rod to swing approximately 30 degrees before contacting the box. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Hangers which are to be used with flat iron duct straps will be provided with eye bolts on both ends.

B. Springs shall be coated with a polyester epoxy powder. Hardware shall be stainless steel, or zinc plated. Steel housings shall be painted or galvanized.

C. Spring-Flex hangers shall be Series RSH-30A as manufactured by Vibration Mountings and Controls, Inc. Hangers with eyebolts to be type RSHSC as manufactured by Vibration Mountings and Controls, Inc. Hangers with eyebolts to be type RSHSC as manufactured by Vibration Mountings and Controls, Inc.

2.8 TYPE 7 MOUNTINGS - PRE-COMPRESSED HANGERS:

A. Spring-Flex hangers shall consist of a color coded steel spring in series with a neoprene element molded in specific colors for proper identification of rated load capacity. Springs shall be pre-compressed to the rated deflection so as to support the suspended equipment or piping at a fixed elevation during installation regardless of load changes. For 30 degree misalignment capability, spring diameters and hanger box lower hole sizes shall be of sufficient size to permit the hanger rod to swing approximately 30 degrees before contacting the box.

B. Springs shall be coated with a polyester epoxy powder. Hardware shall be stainless steel, or zinc plated. Steel housings shall be painted or galvanized.

C. Spring-Flex hangers shall be Series RSHPR or RSHPR-30A for 30 degree misalignment capability, as manufactured by Vibration Mountings and Controls, Inc.

2.9 TYPE 8 MOUNTINGS - SPRING HANGERS:

A. Spring-Flex hangers shall consist of a color coded steel spring with a neoprene and steel washer which will properly distribute the load on the spring. For 30 degree misalignment capability, spring diameters and hanger box lower hole sizes shall be of sufficient size to permit the hanger rod to swing approximately 30 degrees before contacting the box. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Hangers where are to be used with flat iron duct straps will be provided with eye bolts on both ends.

B. Springs shall be coated with a polyester epoxy powder. Hardware shall be stainless steel, or zinc plated. Steel housings shall be painted or galvanized.

C. Spring-Flex hangers shall be Series SH or SH-30A for 30 degree misalignment capability, as manufactured by Vibration Mountings and Controls, Inc. Hangers with eyebolts to be Type SHSC or SHSC-30A for 30 degree misalignment capability, as manufactured by Vibration Mountings and Controls, Inc.

2.10 TYPE 9 MOUNTINGS - HORIZONTAL THRUST RESTRAINTS:

A. Horizontal Thrust Restraints shall be provided to prevent excessive movement of air handling equipment having air thrust which exceeds 10% of the unit weight. The horizontal thrust restraint shall consist of a steel housing containing a steel spring in series with a neoprene pad. The restraint assembly shall be designed to be pre-adjusted by the manufacturer and permit further adjustment in the field to limit horizontal movement to a maximum of 1/4 inch. Assembly shall be furnished with back up plates and hardware for attachment to both the equipment and ductwork or structure. Horizontal restraints shall be attached on the centerline of thrust on each side of the unit.

B. Springs shall be color coded for proper identification of rated load capacity. Springs shall be coated with a polyester epoxy powder. Hardware shall be stainless steel, or zinc plated. Steel housings shall be painted or galvanized.

C. Springs shall be color coded for proper identification of rated load capacity. Springs shall be coated with a polyester epoxy powder. Hardware shall stainless steel, or zinc plated. Steel housings shall be painted or galvanized.

D. Horizontal thrust restrains shall be Series HTR as manufactured by Vibration Mountings and Controls.

2.11 TYPE 10 MOUNTINGS - FLOOR, WALL, AND CEILING SLEEVES:

A. Where piping passes through walls, floors, or ceilings, a vibration control sleeve shall be provided to reduce the transmission of vibration. The sleeve shall consist of two pipe halves with neoprene sponge material bonded to the inside and a bolting arrangement for secure fit around piping. Where temperature exceeds 240 degrees F., an appropriate density fiberglass shall be used in place of neoprene material.

B. Sleeve shall be type VCS as manufactured by Vibration Mountings and Controls, Inc.

2.12 TYPE 11 MOUNTINGS - RESILIENT PIPE GUIDES:

A. Where vertical piping runs between support points, a resilient pipe guide shall be provided. The guide shall consist of an angle frame and four double deflection neoprene mountings molded in specific colors for proper identification of rated load capacity.

B. Resilient Pipe Guide shall be type RPG as manufactured by Vibration Mountings and Controls, Inc.

2.13 TYPE 12 MOUNTINGS - PIPE ANCHORS:

A. Multi-directional pipe anchor shall consist of suitable steel sections in series with heavy duty duck and neoprene material assembled in a telescopic housing to provide the necessary restraint in both the vertical and horizontal directions. Pipe anchor shall be sized to limit load on neoprene and duck material to 500 psi.

B. Multi-directional Pipe Anchor shall be type MDPA as manufactured by Vibration Mountings and Controls, Inc.

C. Pipe anchors are not required for grooved piping with flexible couplings.

2.14 TYPE 13 - FLEXIBLE CONNECTORS:

A. Install Quiet-Sphere Flexible Connectors at the suction and discharge of each pump and inlet and outlet of each chiller, condenser, boiler, cooling tower, and all floor mounted and inline pumps. The connectors shall be molded in spherical design of multiple layers of neoprene and synthetic fiber with integral corrosion resistant plate steel flanges. The connectors shall be suitable for pressures up to 214 psi and temperatures up to 240 degrees F. Where piping is not anchored, control rods must be installed at each connector to limit movement within their specified limits.

B. Flexible connectors shall be Quiet-Sphere Type VMT, or VMU as manufactured by Vibration Mountings & Controls, Inc.

2.15 TYPE 14 - SEISMIC SPRINGS WITH INTERNAL RESTRAINTS:

A. Steel spring isolator incorporating elastomeric snubbing in all directions. The snubber shall be adjustable in the vertical direction and allow a maximum of 1/4 inch travel in all directions before contacting the elastomer cushion.

B. Spring diameter shall be no less than 0.8 times the compressed height of the spring at rated load. Springs shall also have a minimum additional travel to solid equal to 50% of the rated deflection.

C. Housing shall have provision to adjust the rebound plate and to inspect the spring. Housing shall be of cast ductile iron, malleable cast iron or of welded steel construction. Gray iron castings are not permitted.

D. Springs shall be color coded for proper identification of rated load capacity. Springs shall be coated with a polyester epoxy powder. Hardware shall be stainless steel, or zinc plated.

E. Mounting shall be Series AEQM or AWMR as manufactured by Vibration Mountings & Controls, Inc.

2.16 TYPE 15 - SEISMIC SNUBBERS/RESTRAINTS:

A. All-directional Seismic Snubbers shall include all directional elastomer elements, having a minimum elastomer thickness of 3/4 inch in all directions. Elastomers shall be easy to inspect and shall consist of replaceable elastomer inserts. Elastomer shall be neoprene or a high quality rubber including anti-ozone and anti-oxidant materials. For installations where the expected temperature range is -20 degrees F. to +180 degrees F., the elastomer shall be neoprene conforming to either:

1. ASTM D2000 Grade 2BC; or Bridge Bearing Neoprene.

B. For installations where the expected operating temperature range can be as low as -65 degrees F. or a high as +300 degrees F., the elastomer shall be Ethylene Propylene Diene Monomer (EPDM) conforming to ASTM D2000.

C. Snubbers shall be manufactured with an air gap between steel and elastomer of 1/8 inch to 1/4 inch. Snubbers shall be installed with factory set clearances.

D. Snubber must have at least two anchor bolt holes and shall have an ultimate load capacity of at least four times the rated static load capacity.

E. Seismic Snubber shall be Seismic Restraint Series SR/SRD as manufactured by Vibration Mountings & Controls, Inc.

2.17 TYPE 16 - CABLE RESTRAINTS:

A. Steel aircraft cable restraints are designed and installed to limit motion on suspended isolated equipment, piping or ducting. Cables are installed with enough slack to engage only when 1/4 movement occurs. On suspended equipment, cables are installed in sets of four, located at 45 degree angles to all three axes. Where required at pipe hangers, cables are placed two at each location, alternating orientation at successive locations.

B. Cables shall be 7 x 19 galvanized or stainless steel aircraft cable conforming to FED-STD-RR-W-410D. Cable diameters shall be available in at least three sizes to provide cost effective method of support for a wide range of supported loads.

C. Seismic cable restraints shall be Series SCR as manufactured by Vibration Mountings & Controls, Inc.

2.18 TYPE 17 - ELASTOMER MOUNTINGS:

A. Consists of a captive elastomeric mount molded from neoprene or EPDM compound conforming to the requirements of ASTM D2000. Load bearing elastomer element shall be housed in either a heat treated cast aluminum housing or machined structural plate.

B. Mount shall incorporate a fail-safe captive design, and shall provide a vertical natural frequency of 15 Hz to 25 Hz, depending upon the static load. Mount shall be capable of providing dynamic deflections of up to .12 inches.

C. Use Vibration Mountings & Controls Series RB1, RB3 or RB4 with structural plate or MB1 or MB3 (aluminum housing).

2.19 BASES AND RAILS:

A. TYPE A - STRUCTURAL BASES:

1. Integral structural steel bases shall be rectangular in shape. All structural members shall be of wide flange, angle or channel steel with depth equal to a minimum of 1/10 of the longest span of equipment, but not less than 6 inches. Built-in adjustable motor slide rails and height saving brackets shall be supplied as an integral part of the base.
2. Integral structural steel bases shall be type WFB as manufactured by Vibration Mountings & Controls, Inc.

B. TYPE B - STRUCTURAL RAILS:

1. Structural steel rails shall be of the wide flange, angle or channel steel with depth equal to a minimum of 1/10 of the longest span of equipment, but not less than 6 inches. Height saving brackets shall be supplied as an integral part of the rails. For seismic applications rails must be structurally attached to one another.
2. Structural steel rails shall be Type WFR as manufactured by Vibration Mountings & Controls, Inc.

C. TYPE C - CONCRETE INERTIA BASE:

1. Concrete Inertia Base Pouring Forms shall be of formed steel members with a depth not less than 1/12 of the longest base dimension, but not less than 6 inches. Height saving isolator mounting brackets shall be bolted or welded to the members. Pouring forms shall include minimum 3/8 inch concrete reinforcing steel (rebar) on 8 inch centers running the length and width of the base. Pouring forms for Split Case Pumps shall be wide enough to support suction and discharge elbows. Anchor bolt templates shall be provided to accept mounting hole location of the supported equipment. Bolted modular designs may be supplied for bases 6" or 10" thick.
2. Bases shall be Type MPF for Modular style or Type WPF for Welded style, as manufactured by Vibration Mountings & Controls, Inc.

D. TYPE D - ROOF CURB:

1. Provide welded 14 gauge galvanized steel shell and base plate curb with 1 1/2" thick 3 pound density rigid insulation and factory installed wood nailer. All plumbing and electrical connections to the equipment shall be flexible with water connections provided by double sphere neoprene union type flexible connections. Curb shall accommodate sloping steel where required.
2. Curb shall be as manufactured by Thybar, Pate, or approved equal.
3. Provide curb with acoustical treatments.

    (a) Curb shall have 1” fiberglass absorber along inside perimeter of curb.
    (b) Provide 2” fiber glass absorber in bottom of curb.
    (c) Steel roof deck and roof insulation shall not be removed from inside of curb.

(d) Rails to support rooftop equipment shall be designed to provide isolation against the transmission of fabrications to the building structure. Rail assembly shall consist of extruded of roll-formed top and bottom members with spring isolators incorporated and with a continuous air and water seal provided for the entire rail perimeter. Spring isolators shall be selected and spaced according to weight distribution.

(e) Roof Curb Rails designed to be mounted atop curb systems shall be Model ESR, as manufactured by Kinetics Noise Control (or approved equal).

PART 3 - EXECUTION

3.1 PERFORMANCE OF VIBRATION ISOLATORS AND SEISMIC RESTRAINTS:

A. The manufacturer shall warrant the selection, sizing, and application of all vibration isolators and seismic restraints for each application.

B. The seismic engineer shall supervise and review the installation of all seismic restraints.

3.2 APPLICATIONS:

A. General: Except as otherwise indicated, apply the following types of vibration isolators and seismic restraints for the indicated items of Equipment.

3.3 VIBRATION ISOLATOR/SEISMIC RESTRAINT SCHEDULE

	EQUIPMENT	TYPE	DEFLECTION
1.	Pumps	13 and 16	---
2.	Roof Mounted ERUs and RTUs	D and 13	1
3.	Fans		
	Centrifugal set on roof curbs	14	1
	In line fans suspended	4 and 16	1/2
4.	Air Cooled Refrigerant Compressor and		
(a)	VAV Boxes	16	---
(b)	Heating Hot Water Piping	16	---
(c)	Ductwork	16	---

B. Piping Restraints: Applicable for threaded, welded, soldered, and grooved piping; schedule 10, 20, 40 and 80: Install cable restraints at maximum intervals of 40 ft. for transverse bracing and 80 ft. for longitudinal bracing, and at each change in direction. Actual spacing shall be determined by the seismic engineer.

C. Ductwork Restraints: Applicable for galvanized, carbon, and stainless steel ductwork systems: Install cable restraints at maximum intervals of 30 ft. for transverse bracing and 60 ft. for longitudinal bracing and at each change in direction. Actual spacing shall be determined by the Seismic Engineer.

D. Flexible Duct Connectors: Install at the following ductwork connections:

1. Connections with vibration-isolation-mounted air handling equipment.

2. Connections with fixed wall louvers for air intake and exhausts.

E. Flexible Pipe Connectors: Install in piping systems at the following locations:

1. Connections, 3/4" pipe size and larger, with vibration isolation mounted equipment.

3.4 INSTALLATION:

A. Isolation systems shall be installed in strict accordance with the Manufacturer's written instructions and submittal data. Locations of all vibration isolation products shall be selected for ease of inspection and adjustment, as well as for proper operation. Electrical and plumbing connections to vibration isolated equipment shall be flexible.

B. All vibration isolators shall be leveled and aligned squarely below the mounting points of the supported equipment. Isolators for equipment with bases shall be located on the sides of the bases which are parallel to the equipment shaft (generally, the long axis) unless this is not possible because of physical restraints.

C. Unless otherwise indicated, there shall be a minimum operating clearance of 1 inch between inertia bases or structural steel frames and the concrete housekeeping pad or floor beneath the equipment. The clearance space shall be checked by the Contractor to ensure that no construction debris has been left to short circuit or restrict the proper operation of the vibration isolation system.

D. Vibration isolation hangers shall be positioned as high as possible in the hanger rod assembly, and so that the hanger housings may rotate a full 360 degrees without touching any object. Hanger rods shall not contact any object which would short out the vibration isolation systems. Parallel running pipes may be hung together on a trapeze which is isolated from the building. Do not mix vibration isolated and non-vibration isolated pipes on the same trapeze.

E. Attention must be paid to movements of piping caused be expansion and contraction.

F. For Seismic installations, all floor mounted equipment, whether isolated or not, shall be bolted or welded to the structure to resist seismic forces. Bolt attachments, diameter of inserts, embedment depth and weld length as shown on approved submittal drawings, shall be followed in all respects.

G. Seismic restraints shall be installed after equipment is in operating position to assure design clearances are maintained.

3.5 EXAMINATION OF RELATED WORK:

A. Installer of vibration isolation work shall observe the installation of other Work related to vibration isolation work, including work connected to vibration isolation work; and after completion of other related Work (but before Equipment startup), shall furnish a written report to the Engineer listing observed inadequacies for proper operation and performance of vibration isolation work. Report shall cover, but not necessarily be limited to the following:

1. Equipment installations (performed as Work of other Sections) on vibration isolators.
2. Piping connections including flexible connections.

B. Do not start up Equipment until inadequacies have been corrected in a manner acceptable to vibration isolation installer.

3.6 INSPECTION:

A. Upon completion of installation of all vibration isolation and seismic restraint devices, a certification report prepared by the Seismic Engineer shall be submitted in writing to the contractor indicating that all systems are installed properly and in compliance with the specifications. The report must identify those areas that require corrective measures or certify that none exists. Any field coordination type changes to the originally submitted seismic restraint designs must be clearly defined and detailed in the report.

END OF SECTION 23.0549

SECTION 23.0554 - MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. In addition to this section, refer to drawings and/or other sections for complete extent of mechanical identification work required.

1.3 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacture of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. ANSI Standards: Comply with ANSI A13.1 for lettering size, colors, and viewing angles of identification devices.

1.4 SUBMITTALS:

A. Product Data: Submit product specifications and installation instructions for each identification material and device required.

B. Samples: Submit samples of each color, lettering style and other graphic representation required for each identification materials or system.

C. Schedules: Submit valve schedule for each piping system, typewritten and reproduced on 8-1/2" x 11" bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags" in margin of schedule. In addition to mounted copies, furnish extra copies for Maintenance Manuals as specified in Division 1.

D. Provide AutoCad floor plans showing locations and number designations for valves.

PART 2 - PRODUCTS

2.1 MECHANICAL IDENTIFICATION MATERIALS:

A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division-23 sections. Where more than single type is specified for application, selection is Installer's option, but provide single selection for each product category.

B. Plastic Pipe Markers:

1. General: Provide manufacturer's standard pre-printed, flexible or semi-rigid, permanent, color coded, plastic-sheet pipe markers, complying with ANSI A13.1.
    a. Small Pipes: For external diameters 2" and smaller (including insulation if any), provide full-bank pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:
        1) Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
    b. Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by Architect/Engineer in cases of variance with names as shown or specified.
    c. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastics.

C. Stencils:

1. Provide with clean cut symbols and letters of following sizes:
    a. 2-1/2" to 6" outside diameter of pipe or insulation: 12" long color field, 1-1/4" high letters.
    b. 8" to 12" outside diameter of pipe or insulation: 24" long color field, 2-1/2" high letters.

D. Valve Tags:

1. Engraved plastic tags: Provide laminated three-layer with engraved black letters on light contrasting background color. Piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener.
2. Provide 1-1/2" diameter tags, except as otherwise indicated.

E. Valve Tag Fasteners: Manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

F. Valve Schedule Frames:

1. General: For each page of the valve schedule, provide a glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

G. Engraved Plastic-Laminate Signs:

1. General: Provide engraving stock melomine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and working indicate, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
2. Thickness: 1/16" for units up to 20 sq. in. or 8" length; 1/8" for larger units.
   a. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substance.
3. Letter Size: 3"

H. Manufacturer:

1. General: Subject to compliance with requirements, provide mechanical identification materials of one of the following:
   a. Brady (W.H.) Company, Signmark Div.
   b. Seton Name Plate Corp.

2.2 LETTERING AND GRAPHICS:

A. General: Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified or schedule. Provide numbers, lettering and working as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.

1. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples: Boiler No. 3, Air Supply No. 1H, Standpipe F12).

2.3 APPLICATION AND INSTALLATION:

A. General Installation Requirements:

1. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of coverings and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

B. Piping System Identification:

1. General: Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:
   a. Stenciled markers, including color-coded background band or rectangle, and contrasting lettering of black or white. Extend color band or rectangle 2" beyond ends of lettering.
   b. Plastic pipe markers, with application system as indicated under "Materials" in this section. Install on pipe insulation segment where required for hot non-insulated pipes.
2. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces.
3. Near each valve and control device.
   a. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
4. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
5. At access doors, manholes and similar access points which permit view of concealed piping.
6. Near major equipment items and other points of origination and termination.
   a. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.
7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.
8. For HVAC piping, use green background with white letters. Submit all designations prior to installation for approval and the following designations.
   a. Hot water supply HWS
   b. Hot water Return HWR

C. Valve Identification:

1. General: Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, and HVAC terminal devices. List each tagged valve in valve schedule for each piping system.
2. Mount valve schedule frames and schedules in machine rooms where indicated or, of not otherwise indicated, where directed by Architect/Engineer.

D. Mechanical Equipment Identification: Provide marker on ceiling grid below VAV boxes, fan coils, etc. with equipment ID numbers.

1. General: Install engraved plastic laminate sign on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:
   a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
   b. Pumps
   c. Exhaust Fans.
   d. Rooftop Units.
   e. Energy Recovery Units.

f. Expansion Tanks.
g. Boilers.
h. VAV boxes.
i. Terminal Heating Equipment.
j. Condensing Units.

PART 3 - EXECUTION

3.1 MECHANICAL IDENTIFICATION:

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Install underground plastic pipe markers 6 to 8” below finished grade, directly above buried pipe.

F. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with stencil painting. Small devices, such as in-line pumps, may be identified with tags.

G. Identify control panels and major control components outside panels with plastic nameplates.

H. Identify thermostats relating to terminal boxes or valves with nameplates.

I. Identify valves in main and branch piping with tags.

J. Identify air terminal units and radiator valves with numbered tags.

K. Tag automatic controls, instruments, and relays. Key to control schematic.

L. Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 3/4" diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20' on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

M. Identify ductwork with stenciled painting. Identify with air handling unit identification number and areas served.

N. Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

O. Provide Valve Identification Chart. Post framed chart in Boiler Room.

END OF SECTION 23.0554

SECTION 23.0593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of hydronic and refrigerating systems.

C. Measurement of final operating condition of HVAC systems.

D. Sound measurement of equipment operating conditions.

E. Vibration measurement of equipment operating conditions.

1.2 REFERENCES

A. AABC MN-1 - AABC National Standards for Total System Balance; Associated Air Balance Council; 2002.

B. ASHRAE Std 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2008.

C. NEBB (TAB) - Procedural Standards for Testing Adjusting Balancing of Environmental Systems; National Environmental Balancing Bureau; 2015, Seventh Edition.

D. SMACNA (TAB) - HVAC Systems Testing, Adjusting, and Balancing; Sheet Metal and Air Conditioning Contractors' National Association; 2002.

1.3 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.

1. Submit to Architect.
2. Submit six weeks prior to starting the testing, adjusting, and balancing work.

3. Include certification that the plan developer has reviewed the contract documents, the equipment and systems, and the control system with the Architect and other installers to sufficiently understand the design intent for each system.
4. Include at least the following in the plan:

    a. Preface: An explanation of the intended use of the control system.
    b. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
    c. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
    d. Identification and types of measurement instruments to be used and their most recent calibration date.
    e. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
    f. Final test report forms to be used.
    g. Detailed step-by-step procedures for TAB work for each system and issue, including:

        1) Terminal flow calibration (for each terminal type).
        2) Diffuser proportioning.
        3) Branch/submain proportioning.
        4) Total flow calculations.
        5) Rechecking.
        6) Diversity issues.

    h. Expected problems and solutions, etc.
    i. Criteria for using air flow straighteners or relocating flow stations and sensors; analogous explanations for the water side.
    j. Details of how TOTAL flow will be determined; for example:
        1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
        2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.

    k. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and methods to verify this.
    l. Confirmation of understanding of the outside air ventilation criteria under all conditions.
    m. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
    n. Method of checking building static and exhaust fan and/or relief damper capacity.
    o. Proposed selection points for sound measurements and sound measurement methods.
    p. Methods for making coil or other system plant capacity measurements, if specified.
    q. Time schedule for TAB work to be done in phases (by floor, etc.).
    r. Description of TAB work for areas to be built out later, if any.
    s. Time schedule for deferred or seasonal TAB work, if specified.

t. False loading of systems to complete TAB work, if specified.
u. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
v. Interstitial cavity differential pressure measurements and calculations, if specified.
w. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
x. Procedures for formal progress reports, including scope and frequency.
y. Procedures for formal deficiency reports, including scope, frequency and distribution.

D. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB which affect the control system setup and operation.

E. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

1. Revise TAB plan to reflect actual procedures and submit as part of final report.
2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
3. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
4. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
5. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
6. Test Reports: Indicate data on AABC MN-1 forms, forms prepared following ASHRAE Std 111, or NEBB forms.
7. Include the following on the title page of each report:

a. Name of Testing, Adjusting, and Balancing Agency.
b. Address of Testing, Adjusting, and Balancing Agency.
c. Telephone number of Testing, Adjusting, and Balancing Agency.
d. Project name.
e. Project location.
f. Project Architect.
g. Project Engineer.
h. Project Contractor.
i. Report date.

1.4 QUALITY ASSURANCE

A. Perform total system balance in accordance with AABC MN-1, ASHRAE Std 111, or NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.

1. Maintain one copy of each document on site.

B. TAB Agency Qualifications: Company specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum three years documented experience certified by AABC or NEBB.

C. Perform Work under supervision of AABC Certified Test and Balance Engineer or NEBB Certified Testing, Balancing and Adjusting Supervisor experienced in performance of this Work and licensed at the Pennsylvania.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:

1. AABC MN-1, AABC National Standards for Total System Balance.
2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
3. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
4. SMACNA HVAC Systems Testing, Adjusting, and Balancing.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:

1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
2. Having minimum of three years documented experience.
3. Certified by one of the following:

a. AABC, Associated Air Balance Council: www.aabchq.com; upon completion submit AABC National Performance Guaranty.

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.2 TESTING, ADJUSTING, AND BALANCING AGENCIES

A. H.T. Lyons.

B. Optimum Performance Balancing.

C. Associated Air Balance Engineers.

D. Eastern Air Balancing

E. Mountain Air Balancing.

3.3 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:

1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Hydronic systems are flushed, filled, and vented.
13. Pumps are rotating correctly.
14. Proper strainer baskets are clean and in place.
15. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies noted during performance of services which prevent system balance.

C. Beginning of work means acceptance of existing conditions.

3.4 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.5 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:

1. Running log of events and issues.
2. Discrepancies, deficient or uncompleted work by others.
3. Contract interpretation requests.
4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on the drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

G. Check and adjust systems approximately six months after final acceptance and submit report.

3.6 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Affect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions.

L. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

3.7 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.8 MINIMUM DATA TO BE REPORTED

A. Electric Motors:

1. Manufacturer
2. Model/Frame
3. HP/BHP
4. Phase, voltage, amperage; nameplate, actual, no load
5. RPM
6. Service factor

7. Starter size, rating, heater elements
8. Sheave Make/Size/Bore

B. V-Belt Drives:

1. Identification/location
2. Required driven RPM
3. Driven sheave, diameter and RPM
4. Belt, size and quantity
5. Motor sheave diameter and RPM
6. Center to center distance, maximum, minimum, and actual

C. Pumps:

1. Identification/number
2. Manufacturer
3. Size/model
4. Impeller
5. Service
6. Design flow rate, pressure drop, BHP
7. Actual flow rate, pressure drop, BHP
8. Discharge pressure
9. Suction pressure
10. Total operating head pressure
11. Shut off, discharge and suction pressures
12. Shut off, total head pressure

D. Combustion Equipment:

1. Boiler manufacturer
2. Model number
3. Serial number
4. Firing rate
5. Overfire draft
6. Gas meter timing dial size
7. Gas meter time per revolution
8. Gas pressure at meter outlet
9. Gas flow rate
10. Heat input
11. Burner manifold gas pressure
12. Percent carbon monoxide (CO)
13. Percent carbon dioxide (CO2)
14. Percent oxygen (O2)
15. Percent excess air
16. Flue gas temperature at outlet
17. Ambient temperature
18. Net stack temperature

19. Percent stack loss
20. Percent combustion efficiency
21. Heat output

E. Air Cooled Condensers:

1. Identification/number
2. Location
3. Manufacturer
4. Model number
5. Serial number
6. Entering DB air temperature, design and actual
7. Leaving DB air temperature, design and actual
8. Number of compressors

F. Cooling Coils:

1. Identification/number
2. Location
3. Service
4. Manufacturer
5. Air flow, design and actual
6. Entering air DB temperature, design and actual
7. Entering air WB temperature, design and actual
8. Leaving air DB temperature, design and actual
9. Leaving air WB temperature, design and actual
10. Water flow, design and actual
11. Water pressure drop, design and actual
12. Entering water temperature, design and actual
13. Leaving water temperature, design and actual
14. Saturated suction temperature, design and actual
15. Air pressure drop, design and actual

G. Heating Coils:

1. Identification/number
2. Location
3. Service
4. Manufacturer
5. Air flow, design and actual
6. Water flow, design and actual
7. Water pressure drop, design and actual
8. Entering water temperature, design and actual
9. Leaving water temperature, design and actual
10. Entering air temperature, design and actual
11. Leaving air temperature, design and actual
12. Air pressure drop, design and actual

H. Air Moving Equipment:

1. Location
2. Manufacturer
3. Model number
4. Serial number
5. Arrangement/Class/Discharge
6. Air flow, specified and actual
7. Return air flow, specified and actual
8. Outside air flow, specified and actual
9. Total static pressure (total external), specified and actual
10. Inlet pressure
11. Discharge pressure
12. Sheave Make/Size/Bore
13. Number of Belts/Make/Size
14. Fan RPM

I. Return Air/Outside Air:

1. Identification/location
2. Design air flow
3. Actual air flow
4. Design return air flow
5. Actual return air flow
6. Design outside air flow
7. Actual outside air flow
8. Return air temperature
9. Outside air temperature
10. Required mixed air temperature
11. Actual mixed air temperature
12. Design outside/return air ratio
13. Actual outside/return air ratio

J. Exhaust Fans:

1. Location
2. Manufacturer
3. Model number
4. Serial number
5. Air flow, specified and actual
6. Total static pressure (total external), specified and actual
7. Inlet pressure
8. Discharge pressure
9. Sheave Make/Size/Bore
10. Number of Belts/Make/Size
11. Fan RPM

K. Duct Traverses:

1. System zone/branch
2. Duct size
3. Area
4. Design velocity
5. Design air flow
6. Test velocity
7. Test air flow
8. Duct static pressure
9. Air temperature
10. Air correction factor

L. Duct Leak Tests:

1. Description of ductwork under test
2. Duct design operating pressure
3. Duct design test static pressure
4. Duct capacity, air flow
5. Maximum allowable leakage duct capacity times leak factor
6. Test apparatus

    a. Blower
    b. Orifice, tube size
    c. Orifice size
    d. Calibrated

7. Test static pressure
8. Test orifice differential pressure
9. Leakage

M. Terminal Unit Data:

1. Manufacturer
2. Type(constant, variable, fan powered, single, dual duct)
3. Identification/number
4. Location
5. Model number
6. Size
7. Minimum static pressure
8. Minimum design air flow
9. Maximum design air flow
10. Maximum actual air flow
11. Inlet static pressure

N. Air Distribution Tests:

1. Air terminal number
2. Room number/location
3. Terminal type
4. Terminal size
5. Area factor
6. Design velocity
7. Design air flow
8. Test (final) velocity
9. Test (final) air flow
10. Percent of design air flow

O. Sound Level Reports:

1. Location
2. Octave bands - equipment off
3. Octave bands - equipment on

P. Vibration Tests:

1. Location of points:

    a. Fan bearing, drive end
    b. Fan bearing, opposite end
    c. Motor bearing, center (if applicable)
    d. Motor bearing, drive end
    e. Motor bearing, opposite end
    f. Casing (bottom or top)
    g. Casing (side)
    h. Duct after flexible connection (discharge)
    i. Duct after flexible connection (suction)

2. Test readings:

    a. Horizontal, velocity and displacement
    b. Vertical, velocity and displacement
    c. Axial, velocity and displacement

3. Normally acceptable readings, velocity and acceleration
4. Unusual conditions at time of test
5. Vibration source (if non-complying)

END OF SECTION 23.0593

SECTION 23.0714 - HVAC DUCT INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Duct insulation.

B. Duct Liner.

C. Exterior duct insulation.

1.2 RELATED SECTIONS

A. Section 23 0554 – Mechanical Identification.

1.3 REFERENCES

A. ASTM C 553 - Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2002.

B. ASTM C 612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2004.

C. ASTM C 1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2005.

D. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2005.

E. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials; 2005.

F. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

G. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; 2003.

I. IECC 2021 - International Energy Conservation Code.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures which ensure acceptable workmanship and installation standards will be achieved.

D. Submit MSS information for all products.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than five years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum 5 years of experience and approved by manufacturer.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

C. Store indoors or in suitable storage facilities. Do not store outdoors.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

C. All insulation and adhesives shall be formaldehyde free.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

2.2 GLASS FIBER, FLEXIBLE

A. MANUFACTURER:

1. Johns Manville Corporation: www.jm.com. Microlite XG.

    a. Approved formaldehyde-free equal.

2. Insulation: ASTM C 553-92; formaldehyde-free, flexible glass fiber, noncombustible blanket.

    a. 'K' ('Ksi') value: 0.29 at 75 degrees F (0.042 at 24 degrees C), when tested in accordance with ASTM C 518.

        1) Maximum Service Temperature: 250 degrees F (232 degrees C).
        2) Maximum Water Vapor Sorption: 5.0 percent by weight.

3. Vapor Barrier Jacket:

    a. Porous interior sealant primers shall not have VOC content in excess of 775 grams/liter, less water and compounds exempt by the applicable LEED standard.
    b. Kraft paper with glass fiber yarn and bonded to aluminized film.
    c. Moisture Vapor Permeability: 0.058 ng/Pa s m, when tested in accordance with ASTM E 96/E 96M.
    d. Secure with pressure sensitive tape.

4. Vapor Barrier Tape:

    a. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive formaldehyde-free rubber based adhesive.

2.3 GLASS FIBER, RIGID

A. Manufacturer:

1. Knauf Fiber Glass: www.knauffiberglass.com.
2. Johns Manville Corporation: www.jm.com.
3. Owens Corning Corp: www.owenscorning.com.
4. CertainTeed Corporation: www.certainteed.com.

B. Insulation: ASTM C 612; rigid, noncombustible blanket.

1. 'K' ('Ksi') value: 0.24 at 75 degrees F (0.036 at 24 degrees C), when tested in accordance with ASTM C 518.
2. Maximum service temperature: 450 degrees F (232 degrees C).
3. Maximum Water Vapor Sorption: 5.0 percent.
4. Maximum Density: 8.0 lb/cu ft (128 kg/cu m).
5. Vapor Barrier Jacket:

    a. Kraft paper with glass fiber yarn and bonded to aluminized film.
    b. Moisture Vapor Permeability: 0.058 ng/Pa s m, when tested in accordance with ASTM E 96/E 96M.
    c. Secure with pressure sensitive tape.

2.4 DUCT LINER

A. Manufacturers:

1. Knauf Fiber Glass: www.knauffiberglass.com.
2. Approved equal.

B. Flexible, mat-faced bonded insulation with encapsulated edge coating.

1. Thermal Performance: 1.5" thickness; R-value 6.0 (hr-sqft-F/Btu) or 0.17 conductness.
2. Service temperature: up to 250 degrees F.
3. Rated velocity on coated side for air erosion: 6,000 fpm minimum.
4. Minimum noise reduction coefficients: 1.5 inch thickness; 0.80.

C. Liner Fasteners: Galvanized steel, welded with integral head.

2.5 EXTERIOR DUCTWORK INSULATION

A. Externally insulated ductwork:

1. Insulate ducts outside with 3" thick rigid polyisocyanurate with a minimum R value of 14.
2. Cover insulation with "VentureClad 1579CW-E" as manufactured by 3M.

B. Pre-manufactured system:

1. Insulation: Pre-manufactured, interlocking, insulated panel system.
2. “Techna-Duct” as manufactured by P.T.M. Manufacturing, L.L.C.
3. 2” thick with R-16 rating.
4. System shall be shop fabricated with laminated polyisocyanurate to a finish of 2” thick and encased with 1.25 mil aluminum.
5. Field measure duct prior to off-site fabrication.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that ducts have been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated ducts conveying air below ambient temperature:

1. Provide insulation with vapor barrier jackets.
2. Finish with tape and vapor barrier jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
5. Insulated ducts conveying air above ambient temperature:
    a. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

D. External Duct Insulation Application:

1. Install without sag on underside of duct. Use welded pin mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
2. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
3. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
4. Install Insulation materials with smooth and even surfaces.
5. Maintain integrity of vapor barrier on ductwork insulation, and protect it to prevent puncture and other damage.
6. Extend ductwork insulation without interruption through walls, floors, and similar ductwork penetrations except where otherwise indicated.

E. Duct and Plenum Liner Application:

1. Adhere insulation with adhesive for 100 percent coverage.
2. Secure insulation with mechanical liner fasteners. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible for spacing.
3. Seal and smooth joints. Seal and coat transverse joints.
4. Seal liner surface penetrations with adhesive.

5. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

3.3 PROTECTION AND REPLACEMENT:

A. Replace damaged insulation, which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

B. Protection: The installer of the ductwork insulation shall advise the contractor of required protection for the insulation work during the remainder of the construction period to avoid damage and deterioration.

3.4 SCHEDULES

A. All fresh air intake ducts from the outside intake louver or vent to the unit casing shall be externally insulated with 2” thick fiberglass.

B. All exhaust and relief air ducts from the backdraft device to the louver shall be externally insulated with 1.5" thick fiberglass.

C. Transfer air ducts shall be acoustically (internally) lined with 1" thick liner where indicated on the plans.

D. All supply and return air ductwork of air conditioning systems shall be externally insulated unless noted to be internally lined (except where ductwork is installed exposed in a conditioned space). Exposed and partially exposed ductwork shall be lined unless noted otherwise.

E. All exhaust air ductwork of energy recovery units shall be externally insulated with 1.5” fiberglass (except where ductwork is installed exposed in a conditioned space).

F. Where interior ducts are internally lined for acoustical treatment, no additional outside duct insulation shall be required.

G. Dual Temperature Ductwork:

1. Application Requirements: Where leaving air temperature is alternately above and below ambient temperature insulate and vapor seal ductwork, except where ductwork is indicated to be acoustically lined.
2. Externally Insulated Ductwork: Provide with one of the following types and thicknesses of insulation, except as otherwise indicated:

    a. Insulation: Rigid mineral fiber, 6 PCF in exposed areas, 1.5” thick with a minimum installed “R” value of 6.0.
    b. Insulation: Flexible mineral fiber, 2" thick, application limited to concealed locations. Density shall be 1.5 pounds/cubic foot with a minimum installed “R” value of 6.0.

H. Lined Ductwork:

1. 1.5” thick duct liner for supply and return air ductwork where duct liner is indicated on the drawings.
2. All transfer ducts shall be lined with 1" thick liner.

I. Exterior Ductwork:

1. Provide either specified product for all dual temperature ductwork located outside of building envelope. Insulation shall be in addition to any internal lining.

END OF SECTION 23.0714

SECTION 23.0716 - HVAC EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Equipment insulation.

B. Covering.

1.2 RELATED SECTIONS

A. Section 23 0554 – Mechanical Identification.

B. Section 23 2113 - Hydronic Piping: Placement of hangers and hanger inserts.

C. Section 23 2114 - Hydronic Specialties.

D. Section 23 2300 - Refrigerant Piping: Placement of inserts.

1.3 REFERENCES

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2007.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2007.

C. ASTM C 177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2004.

D. ASTM C 195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007.

E. ASTM C 449/C 449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007.

F. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2004.

G. ASTM C 533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2009.

H. ASTM C 534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2008.

I. ASTM C 552 - Standard Specification for Cellular Glass Thermal Insulation; 2007.

J. ASTM C 553 - Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2008.

K. ASTM C 612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2009.

L. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010.

M. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials; 2005.

N. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

P. IECC 2021 - International Energy Conservation Code.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for equipment scheduled.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with not less than five years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum 5 years of experience.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

2.2 GLASS FIBER, FLEXIBLE

A. Manufacturers:

1. Knauf Insulation
2. Johns Manville Corporation
3. Owens Corning Corporation
4. CertainTeed Corporation

B. Insulation: ASTM C 553; flexible, noncombustible.

1. 'K' Value: 0.36 at 75 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
2. Maximum Service Temperature: 450 degrees F.
3. Maximum Water Vapor Sorption: 5.0 percent by weight.

C. Vapor Barrier Jacket: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.

1. Moisture Vapor Permeability: 0.029 ng/Pa s m (0.02 perm inch), when tested in accordance with ASTM E 96/E 96M.
2. Secure with self-sealing longitudinal laps and butt strips.

2.3 GLASS FIBER, RIGID

A. Manufacturer:

1. Knauf Insulation
2. Johns Manville Corporation
3. Owens Corning Corporation
4. CertainTeed Corporation

B. Insulation: ASTM C 612 or ASTM C 592; rigid, noncombustible.

1. 'K' Value: 0.25 at 75 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
2. Maximum Service Temperature: 850 degrees F.
3. Maximum Water Vapor Sorption: 5.0 percent by weight.
4. Maximum Density: 8.0 lb/cu ft.

C. Vapor Barrier Jacket:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.029 ng/Pa s m (0.02 perm inch), when tested in accordance with ASTM E 96/E 96M.
3. Secure with self-sealing longitudinal laps and butt strips.

2.4 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:

1. Armacell International
2. Aeroflex USA

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C 534 Grade 3, in sheet form.

1. Minimum Service Temperature: -40 degrees F.
2. Maximum Service Temperature: 220 degrees F.
3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.5 JACKETS

A. PVC Plastic:

1. Manufacturers:

a. Johns Manville Corporation

2. Jacket: Sheet material, off-white color.

a. Minimum Service Temperature: -40 degrees F.
b. Maximum Service Temperature: 150 degrees F.
c. Moisture Vapor Permeability: 0.029 ng/Pa s m (0.02 perm inch), when tested in accordance with ASTM E 96/E 96M.
d. Thickness: 10 mil.

e. Connections: Brush on welding adhesive.

B. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.

1. Thickness: 0.016 inch sheet.
2. Finish: corrugated.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that equipment has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Factory Insulated Equipment: Do not insulate.

C. Exposed Equipment: Locate insulation and cover seams in least visible locations.

D. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

E. Insulated equipment containing fluids below ambient temperature: Insulate entire system.

F. Fiber glass insulated equipment containing fluids below ambient temperature: Provide vapor barrier jackets, factory-applied or field-applied. Finish with glass cloth and vapor barrier adhesive.

G. For hot equipment containing fluids over 140 degrees F, insulate flanges and unions with removable sections and jackets.

H. Fiber glass insulated equipment containing fluids above ambient temperature: Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Finish with glass cloth and adhesive.

I. Inserts and Shields:

1. Application: Equipment 1-1/2 inches diameter or larger.
2. Shields: Galvanized steel between hangers and inserts.
3. Insert location: Between support shield and equipment and under the finish jacket.

4. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

J. Finish insulation at supports, protrusions, and interruptions.

K. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

L. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

M. Replace damaged insulation which cannot be repaired satisfactorily including units with vapor barrier damage and moisture saturated units.

N. Protection: Insulation Installer shall advise the Contractor of required protection for the insulation work during the remainder of the construction period to avoid damage and deterioration.

3.3 SCHEDULE

A. Heating Systems:

1. Air Separators: 2" thick flexible unicellular.
2. Expansion Tanks: 2" thick flexible unicellular.

B. Dual Temperature Systems:

1. VAV Box Re-heat Coil: 1.5" thick fiberglass (except where unit is installed exposed in a conditioned space)

END OF SECTION 23.0716

SECTION 23.0719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.2 RELATED SECTIONS

A. Section 07 8400 - Firestopping.

B. Section 23 2113 - Hydronic Piping: Placement of hangers and hanger inserts.

C. Section 23 2300 - Refrigerant Piping: Placement of inserts.

1.3 REFERENCES

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2007.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2007.

C. ASTM C 177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus; 2004.

D. ASTM C 195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007.

E. ASTM C 449/C 449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2000.

F. ASTM C 533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2009.

G. ASTM C 534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2007a.

H. ASTM C 547 - Standard Specification for Mineral Fiber Pipe Insulation; 2007.

I. ASTM C 552 - Standard Specification for Cellular Glass Thermal Insulation; 2007.

J. ASTM C 578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2009.

K. ASTM C 585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System); 2009.

L. ASTM C 591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation; 2009.

M. ASTM C 610 - Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation; 2009.

N. ASTM C 795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008.

O. ASTM D 1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber; 2007.

P. ASTM D 2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2006.

Q. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010.

R. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials; 2005.

S. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

T. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

U. IECC 2021 - International Energy Conservation Code.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than five years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum 5 years of experience.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

2.2 GLASS FIBER

A. Manufacturers:

1. Knauf Insulation: www.knaufusa.com.
2. Johns Manville Corporation: www.jm.com.
3. Owens Corning Corp: www.owenscorning.com.
4. CertainTeed Corporation: www.certainteed.com.

B. Insulation: ASTM C 547 and ASTM C 795; rigid molded, noncombustible.

1. 'K' value: ASTM C177, 0.24 at 75 degrees F.
2. Maximum service temperature: 850 degrees F.
3. Maximum moisture absorption: 0.2 percent by volume.

C. Insulation: ASTM C 547 and ASTM C 795; semi-rigid, noncombustible, end grain adhered to jacket.

1. 'K' value: ASTM C177, 0.24 at 75 degrees F.
2. Maximum service temperature: 650 degrees F.
3. Maximum moisture absorption: 0.2 percent by volume.

D. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E 96/E 96M of 0.02 perm-inches.

2.3 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:

1. Armacell International: www.armacell.com.
2. Aeroflex USA: www.aeroflexusa.com.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C 534 Grade 1; use molded tubular material wherever possible.

1. Minimum Service Temperature: -40 degrees F.
2. Maximum Service Temperature: 220 degrees F.
3. Connection: Waterproof vapor barrier adhesive.

2.4 JACKETS

A. PVC Plastic.

1. Manufacturers:

a. Johns Manville Corporation: www.jm.com.
b. Owens Corning Corp..
c. Knauf Insulation.

2. Jacket: One piece molded type fitting covers and sheet material, off-white color.

a. Minimum Service Temperature: 0 degrees F.
b. Maximum Service Temperature: 220 degrees F.
c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E 96/E 96M.
d. Thickness: 10 mil.
e. Connections: Brush on welding adhesive. Tape all joints in addition to adhesive.
f. Match

B. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.

1. Thickness: 0.016 inch sheet.
2. Finish: Smooth.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

D. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

E. Inserts and Shields:

1. Application: Piping 1-1/2 inches diameter or larger.
2. Shields:

    a. Galvanized steel (minimum 18 gauge) between pipe hangers or pipe hanger rolls and inserts.
    b. Single-piece Molded Polypropylene Copolymer pipe saddle such as Armacell Insuguard or approved equal.

3. Insert location: Between support shield and piping and under the finish jacket.
4. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert material:

    a. Flexible elastomeric foam, with thickness equal to or greater than the pipe insulation such as ArmaFiix EcoLight Pipe Support.
    b. Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

F. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 8400.

G. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.

H. General: Install insulation products in accordance with the manufacturer's written instructions, and in accordance with the recognized industry practices to ensure that the installation serves its intended purpose.

I. Install insulation of pipe systems subsequent to testing and acceptance of tests.

J. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full length units of insulation, with a single cut piece to complete the run. Do not cut pieces of scraps abutting each other.

K. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure a complete and tight fit over surfaces to be covered.

L. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at installer's option) except where a specific form or type is indicated. Valves in chilled water systems shall be insulated with removable factory pre-molded insulators. Any condensation problems shall be corrected by the Contractor. Damage to finishes caused by condensation shall be corrected by this Contractor.

M. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.

N. Pipe Hanger Insulation Inserts: Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3 inch wide vapor barrier stage or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3 inch wide vapor barrier tape or band.

O. Replace damaged insulation which cannot be repaired satisfactorily including units with vapor barrier damage and moisture saturated units.

P. Protection: Insulation Installer shall advise the Contractor of required protection for the insulation work during the remainder of the construction period to avoid damage and deterioration.

3.3 SCHEDULE

A. HVAC Systems:

1. HVAC PIPING SYSTEM INSULATION:

a. Sub-Freezing Piping (0 to 39 Deg. F.) (-18 to 4 Deg. C.):

1) Application Requirements: Insulate the following sub-freezing HVAC piping systems:

(a) Refrigerant suction and liquid lines between evaporators and condensing units.

2) Insulate each piping system specified above with one of the following types and thickness of insulation:

(a) Insulation: Flexible Closed Cell Elastomeric; 1.0” thick.
(b) Outdoor Application: Cover with 22 gauge corrugated aluminum with all joints sealed watertight.

b. Cold Piping (40 Deg. F. (4.4 Deg. C. to ambient):

1) Application Requirements: Insulate the following cold HVAC piping systems:

(a) Copper air conditioning condensate piping. Insulation not required on PVC condensate piping.

2) Insulate each piping system specified above with one of the following types and thicknesses of insulation:

(a) Insulation: Flexible Closed Cell Elastomeric; 1.5" thick.
(b) Outdoor Application: Increase insulation thickness by 1 inch. Where pipes are heat traced, increase size to accommodate the heat tracing. Cover with 22 gauge corrugated aluminum with all joints sealed watertight.

c. Hot Low Pressure Piping (to 200 Deg. F. (121 Deg. C.):

1) Application Requirements: Insulate the following hot low pressure HVAC piping systems.

(a) HVAC hot water supply and return piping.

2) Insulate each piping system specified above with one of the following types and thickness of insulation:

(a) Insulation: Fiberglass or Flexible Closed Cell Elastomeric; 1 1/2" thick for pipe sizes up to and including 1 1/4” in diameter. 2" thick for pipe sizes 1 1/2" in diameter and larger.

END OF SECTION 23.0719

SECTION 23.0923 – DIRECT DIGITAL CONTROL (DDC) SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes control equipment and installation for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-furnished controls.

B. See "Sequences of Operation" for requirements that relate to this Section.

1.2 SYSTEM DESCRIPTION

A. The Building Automation System (BAS) contractor shall furnish and install a networked system of HVAC controls. The contractor shall incorporating direct digital control (DDC) for central plant equipment, building ventilation equipment, supplemental heating and cooling equipment, and terminal units.

B. Provide networking to new DDC equipment using communication standards. System shall be capable of BACnet communication according to ASHRAE standard ANSI/ASHRAE 135-2010 for interoperability with smart equipment and for the main IP communication trunk to the BAS Server.

1.3 DEFINITIONS

A. DDC: Direct digital controls

B. IP: Internet Protocol

C. I/O: Input/Output

D. LAN: Local area network.

E. TCP: Transfer Control Protocol

F. Scope Terminology

1. Provide = Furnish equipment, engineer, program and install
2. Furnish = Furnish equipment, engineer and program
3. Mount = securely fasten or pipe
4. Install = mount and wire
5. Wire = wire only

1.4 WORK INCLUDED

A. The installation of the control system shall be performed under the direct supervision of the controls manufacturer with the shop drawings, flow diagrams, bill of materials, component designation, or identification number and sequence of operation all bearing the name of the manufacturer.

B. Furnish a complete distributed direct digital control system in accordance with this specification section. This includes all system controllers, logic controllers, and all input/output devices. Items of work included are as follows:

1. Provide a submittal that meets the requirements below for approval.
2. Coordinate installation schedule with the mechanical contractor and general contractor.
3. Provide installation of all panels and devices unless otherwise stated.
4. Provide power for panels and control devices.
5. Provide all low voltage control wiring for the DDC system.
6. Provide miscellaneous control wiring for HVAC and related systems regardless of voltage.
7. Provide engineering and technician labor to program and commission software for each system and operator interface. Submit commissioning reports for approval.
8. Participate in commissioning for all equipment that is integrated into the BAS (Refer to Commissioning sections of the equipment or systems in other parts of this specification.)
9. Provide testing, demonstration and training as specified below.

1.5 SUBMITTALS

A. Provide submittals for fast track items that need to be approved and released to meet the schedule of the project. Provide submissions for the following items separately:

1. Valve schedule and cut sheets
2. Factory mounting and wiring diagrams and cut sheets
3. Thermostat locations

B. Provide a complete submittal with all controls system information for approval before construction starts. Include the following:

1. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
2. Wiring Diagrams: Power, signal, and control wiring.
3. Details of control panel faces, including sizes, controls, instruments, and labeling.
4. Schedule of dampers and actuators including size, leakage, and flow characteristics.
5. If dampers are furnished by other, submit a damper actuator schedule coordinating actuator sizes with the damper schedule.
6. Schedule of valves including leakage and flow characteristics.
7. Written description of the Sequence of Operations.

8. Network riser diagram showing wiring types, network protocols, locations of floor penetrations and number of control panels. Label control panels with network addresses. Show all routers, switches, hubs and repeaters.
9. Point list for each system controller including both inputs and outputs (I/O), point numbers, controlled device associated with each I/O point, and location of I/O device.
10. Starter and variable frequency drive wiring details of all automatically controlled motors.
11. Reduced size floor plan drawings showing locations of control panels, thermostats and any devices mounted in occupied space.

C. Product Data: Include manufacturer's technical literature for each control device indicated, labeled with setting or adjustable range of control. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.

D. Wiring Diagrams: Detail the wiring of the control devices and the panels. Show point-to-point wiring from field devices to the control panel. Show point-to-point wiring of hardwired interlocks. Show a ladder diagram or schematic of wiring internal to the panels, including numbered terminals. Clearly designate wiring that is done at a factory, at a panel shop or in the field.

1.6 QUALITY ASSURANCE

A. Codes

1. Perform all wiring in accordance with Division 26, NEC, local codes and Owner’s requirements.
2. Uniform Building Code (UBC)
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
4. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilation Systems."
5. All equipment shall be UL listed and approved and shall meet with all applicable NFPA standards, including UL 916 - PAZX Energy Management Systems,
6. Provide UL 864 – UUKL Smoke Control, where controllers and networks are used for that purpose.

    a. Provide written approvals and certifications after installation has been completed.

7. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.
8. The manufacturer of the building automation system shall provide documentation supporting compliance with ISO-9002 (Model for Quality Assurance in Production, Installation, and Servicing) and ISO-140001 (The application of well-accepted business management principles to the environment). The intent of this specification requirement is to ensure that the products from the manufacturer are

delivered through a Quality System and Framework that will assure consistency in the products delivered for this project.

B. Qualifications

1. Installing contractor shall be in the business of installing and servicing DDC controls for mechanical systems, temperature and ventilation control, environmental control, lighting control, access and security controls, and energy automation as their primary business. Installer Qualifications: An experienced installer who is the authorized representative of the automatic control system manufacturer for both installation and maintenance of controls required for this Project.
2. Engineering, drafting, programming, and graphics generation shall be performed by the local branch engineers and technicians directly employed by the Building Automation System Contractor.
3. Supervision, checkout and commissioning of the system shall be by the local branch engineers and technicians directly employed by the Building Automation System Contractor. They shall perform commissioning and complete testing of the BAS system.

C. Final determination of compliance with these specifications shall rest solely with the Engineers and Owner who will require proof of prior satisfactory performance.

1.7 COORDINATION

A. Coordinate location of thermostats, humidistats, panels, and other exposed control components with plans and room details before installation.

B. Coordinate power for control units and operator workstation with electrical contractor.

C. Coordinate equipment with provider of starters and drives to achieve compatibility with motor starter control coils and VFD control wiring.

D. Coordinate scheduling with the mechanical contractor and general contractor. Submit a schedule for approval based upon the installation schedule of the mechanical equipment.

E. Products Furnished but Not Installed Under This Section

1. Sheetmetal accessories

a. Dampers
b. Airflow Stations

1.8 WARRANTY

A. Conform to the warranty requirement of the Contract Documents, General Requirements and this section or a minimum of 12 months. This warranty shall apply equally to both hardware and software.

B. Warranty shall cover all costs for parts, labor, associated travel, and expenses for a period of one year from completion of system demonstration.

C. Hardware and software personnel supporting this warranty agreement shall provide on-site or off-site service in a timely manner after failure notification to the vendor. The maximum acceptable response time to provide this service at the site shall be 24 hours.

PART 2 - PRODUCTS

2.1 ACCEPTABLE SYSTEM MANUFACTURERS AND CONTRACTORS

A. Distech Controls as installed by Conexus.

B. Schnider Electric as installed by NRG.

C. Facility Explorer as installed by Eccotrol.

2.2 QUALITY ASSURANCE

A. All new building automation system products on this project shall be provided by a firm that is a registered ISO 9001:2015 manufacturer, for a minimum duration of 5 years, at time of bid.

2.3 COMPUTER HARDWARE

A. Provide the following computer hardware for this project:

1. Onsite Server(s) - Contractor shall utilize existing customer VM
2. Workstation Computer(s) - Contractor shall provide qty. of 1 in this building
3. Local Touchscreen Display(s) - Contractor shall provide as needed
4. Uniterruptable Power Supplies

B. Server Hardware Requirements

1. Utilize existing owner VM

C. Workstation Hardware Requirements

1. The Workstation shall adhere to the following minimum requirements: the latest generation Intel Core i5 processor, 8 GB RAM, and a 500GB solid state hard drive. It shall include the latest Windows 64-bit operating system (Windows 10 pro or newer), Microsoft Office programs, VM support, an ethernet adapter (10/100MB with RJ45 connector), 32X CD-ROM drive, and 2-USB ports.

2. A minimum 21", HDMI, DVI-D video interfaces, minimum 1024 x 768 resolution, 4x3 Widescreen, LED color monitor with a minimum 60 Hz refresh rate shall also be included.
3. A mouse and keyboard shall be provided.
4. Connection to the BAS LAN network shall be via an Ethernet network interface card, 100 Mbps.
5. Workstation(s) should be loaded with Programming Tools
6. Acceptable Manufacturers are:

    a. Dell
    b. Lenovo
    c. HP (Hewlett Packard)

D. Local Touchscreen Display Requirements

1. The Local Touchscreen Display shall be a LCD capacitive touchscreen with a minimum quad core 1.44 GHz processor and support for user authentication via credential entry. It shall be capable of connecting to the BAS either through Wi-Fi or IP connection.
2. Pre-loaded visual interface for simplified commissioning, operations and troubleshooting; including real time notification of alarms, trend viewing, schedule / calendar adjustment, point data view and override, and graphical displays.
3. The local touchscreen display shall be associated with a single BACnet/IP controller such as a mechanical room display for a chilled water controller.
4. Acceptable Manufacturers are:

    a. Distech Horizon-C or Horizon-R
    b. Microsoft Surface Pro

E. Uninterruptable Power Supplies

1. Provide the OWS, Server, and each network/building controller with individual UPS to provide clean, reliable, noise-filtered power at all times and to protect and maintain systems operation throughout short term power interruptions of up to 15 minutes duration.
2. Acceptable Manufacturer is APC.

2.4 REMOTE ACCESS AND CYBER SECURITY BEST PRACTICES

A. Remote Access

1. The BAS contractor shall comply with owner IT infrastructure security policies for remote access. The owner IT team shall provide VPN, firewalls, etc. as needed for secure remote access.
2. A VPN and firewall must be used for secure remote access.

B. Cyber Security Best Practices

1. Unless predetermined by the owner IT team the BAS network shall be separate from the owners IT infrastructure besides a single point connection for remote access (owner provided internet access). All ethernet switches and communication backbone required for a fully operational BAS shall be provided by the BAS contractor.
2. Refer to "Communication Backbone" section of this specification for further details on segmenting the network (VLANs, subnets) and when edge or managed switches are required based on building size / type.
3. Do not use factory provided usernames and passwords. Update passwords and usernames regularly for strong system security.
4. Update software and firmware regularly.
5. Adhere to controls manufacturer hardening guidelines where applicable.

2.5 OPERATOR SOFTWARE

A. Real-Time Displays

1. Provide a visual graphical representation of buildings, floor layouts, each piece of mechanical equipment and/or mechanical system that duplicates the represented system, presented as a web page via any industry standard web browser, where applicable.
2. Graphics shall include at a minimum the value of each input, each output, each setpoint, alarms and graphical representation of trend logs.

B. On-Line Help

1. Provide a context sensitive, on-line help system to assist the operator in operation and editing of the system.

C. Security

1. Each operator shall be required to log on to that system with a user name and password in order to view, edit, add, or delete data.
2. System security shall be selectable for each operator.
3. The system administrator shall have the ability to set passwords and security levels for all other operators.
4. Each operator password shall be able to restrict the operators' access for viewing and/or changing each system application, full screen editor, and object.
5. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected.
6. This auto log-off time shall be set per operator password.
7. All system security data shall be stored in an encrypted format.

D. System Diagnostics.

1. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers.
2. The failure of any device shall be annunciate to the operator.

E. Third-Party Windows-Based Programs

1. The system shall be capable of utilizing third-party Windows-based programs for such things as spreadsheet analysis, graphing, charting, custom report generation, and graphics design packages.
2. Graphics generation shall be done using standard Windows packages.
3. No proprietary graphics generation software shall be needed.

F. Overrides

1. It shall be possible for the operator to override automatic analog and digital output commands.
2. Where the BAS software normally originates these outputs, the provision shall exist for the operator to terminate automatic BAS control of any particular output and to originate a manual analog or digital output command.
3. The provision shall exist for the operator to return analog or digital output command functions to automatic BAS software control.

G. Password Protection

1. Provide security system that prevents unauthorized use unless operator is logged on.

H. Trend Data

1. System shall periodically gather historically recorded selected samples of object data stored in the field equipment (global controllers, field controllers) and archive the information on the operator's workstation (server) hard disk.

    a. Archived files shall be appended with new sample data, allowing samples to be accumulated over 3 years.
    b. Systems that write over archived data shall not be allowed, unless limited file size is specified.
    c. Samples may be viewed at the operator's terminal in a trend log.
    d. Logged data shall be stored in spreadsheet format.
    e. Operator shall be able to scroll through all trend log data.

2. Software shall be included that is capable of graphing the trend logged object data. Software shall be capable of creating two-axis (x,y) graphs that display up to six object types at the same time in different colours and these Graphs shall show object type value relative to time.
3. Operator shall be able to change trend log setup information such as time intervals and objects logged

I. Graphics

1. The operator's workstation shall display all data associated with the project.

    a. Operator's workstation shall display all data using 3-D graphic representations of all mechanical equipment.

2. System shall be capable of displaying graphic file, text, and dynamic object data together on each display.

    a. Information shall be labelled with descriptors and shall be shown with the appropriate engineering units.
    b. All information on any display shall be dynamically updated without any action by the user.
    c. Terminal shall allow user to change all field-resident BAS functions associated with the project, such as setpoints, weekly schedules, exception schedules, etc. from any screen no matter if that screen shows all text or a complete graphic display.

3. Animated graphic objects shall be displayed as a sequence of multiple bitmaps to simulate motion.
4. Analog objects may also be assigned to an area of a system graphic, where the colour of the defined area would change based on the analog objects value.

    a. For example, an area of a floor-plan graphic served by a single control zone would change colour with respect to the temperature of the zone or its deviation from setpoint.

5. Separate Displays shall be supplied, specific to the project, to form the following overall presentation style.
6. All Displays will be linked in a logical fashion using hyperlink style (single left mouse click on text/display object/dynamic to load linked display if programmed)
7. Entire system shall operate without dependency on the operator's terminal. Provide graphic generation software at each workstation.

J. Alarms

1. Operator's terminal shall provide audible, visual, electronic and printed means of alarm indication.
2. Any alarm may be handled based on its individual or assigned class actions.

    a. Displayed on the Alarm console.

        1) The system shall be provided with a dedicated alarm window or console.
        2) This window will notify the operator of an alarm condition, and allow the operator to view details of the alarm and acknowledge the alarm.

b. Alarm reports shall be viewable via the BAS system and available for delivery by electronic mail (e-mail) or printing.

3. System shall provide log of alarm messages. Alarm log shall be archived to the hard disk of the system operator's terminal.

a. Each entry shall include a description of the event-initiating object generating the alarm, time and date of alarm occurrence, time and date of object state return to normal, and time and date of alarm acknowledgement.

K. Scheduling

1. Operator's terminal display of weekly schedules shall show all information in easy-to-read 7-day (weekly) format for each schedule.
2. Exception schedules (non-normal schedules, such as holidays or special events) shall display all dates that are an exception to the weekly schedules.
3. At the operator's terminal, the system user shall be able to change all information for a given weekly or exception schedule if logged on with the appropriate security access.

L. Archiving

1. Store back-up copies of all controller databases in at least one OWS and the server.
2. Provide continuous supervision of integrity of all controller databases.
3. Data base back up and downloading to occur over LAN without operator intervention.
4. Operator to be able to manually download entire controller database or parts thereof.

M. Reports

1. Provide a report facility to generate and format for display, printing, or permanent storage, as selected by the operator, the reports as specified in this section.
2. Provide the software to automatically generate any report specified; the user will be able to specify the type of report, start time and date, interval between reports (hourly, daily, weekly, monthly) and output device.
3. As a minimum, the following reports shall be configured on the system:

a. Dynamic Reports: To allow operator to request a display of the dynamic value for the user specified points which shall indicate the status at the time the request was entered and updated at an operator modifiable scan frequency.
b. Summary Report: To permit the display or printing of the dynamic values for the user specified points.
c. Trend Reports: To permit the trending of points selected by the operator, including as a minimum digital input and output, analog input and output, set points, and calculated values.
d. Historical Data Collection: Provision shall be made to ensure historical data is not lost.

e. Alarm Summary: Provide a summary of all points in alarm and include as a minimum; point acronym, point description, current value, alarm type, limit exceeded, and time and date of occurrence.
f. Disable Point Summary: Provide a summary of all points in the disabled state and include as a minimum point acronym and point description.
g. Run Time Summary: Provide a summary of the accumulated running time of selected pieces of equipment with point acronym and description, run time to date, alarm limit setting. The run time shall continue to accumulate until reset individually by means of suitable operator selection.
h. Schedule Summary: Provide a summary of all schedules and indicate as a minimum, which days are holidays and, for each section, the day of the week, the schedule times and associated values; for digital schedules value will be on or off; for analog schedules value will be an analog value.
i. User Record Summary: Provide a summary of all user records to include as a minimum; user name, password, initials, command access level and point groups assigned.

2.6 BAS CONTROLLERS

A. All controllers on the job shall have the following minimum requirements:

1. IP Communication (BACnet/IP)

a. BACnet/IP communication protocol shall be used for all BAS manufacturer provided controllers (including terminal devices such as VAVs, FCUs, etc.)
b. Support for IPv4 addressing
c. DHCP support and Auto DNS
d. Baud rate of not less than 100 Mbps
e. 2 - RJ45 ports each capable of supporting 10/100 Base-T.

1) Supporting controller daisy chaining on the Ethernet network via integral switch functionality.
2) Integrated fail-safe should allow for communication when the controller is powered down.

f. All controllers shall be able to communicate peer-to-peer without the need for a Network Control Unit (such as JACE, NAE, etc.) and shall be capable of assuming all responsibilities typically assumed by a Network Control Unit.

1) Any controller on the Ethernet Data Link/Physical layer shall be able to act as a Master to allow for the exchange and sharing of data variables and messages with any other controller connected on the same communication cabling. Slave controllers are not acceptable.
2) The resulting network will be a 'Flat' topology with all devices (controllers, workstations, …) connecting at the same physical network level

2. Memory and Processing

    a. 512MB of RAM and 4GB of non-volatile flash memory.
    b. 32-bit microprocessor operating at a minimum of 600 MHz

3. Each individual controller shall have an embedded web-based HTML5 visual interface with the following functionality without reliance on any other controller for access:

    a. Typical and custom control processes
    b. Scheduling
    c. Energy management applications
    d. Alarm management applications
    e. Historical/trend data for points specified
    f. Maintenance support applications
    g. Graphical interface

4. Shall be capable of monitoring/controlling the following types of inputs/outputs:

    a. Digital inputs from dry contact closure, pulse accumulators, voltage sensing.
    b. Analog inputs of 4-20 mA, 0-10 Vdc, thermistor and RTD in the range 0 to 350,000 ohm.
    c. Digital outputs including Form C relay outputs and Triac outputs
    d. Analog outputs of 4-20 mA and 0-10 Vdc.

5. A minimum of 10% spare capacity shall be provided for each point type for future point connection.
6. Any software required for programming shall be unlicensed and openly available
7. Auto commissioning features shall be available for VAVs and FCUs to schedule automatic testing and record values (air flows, pressures, temperatures, etc.) for different operating modes. The auto commissioning feature shall be able to email reports and run commissioning on a specified schedule.
8. Power and Environmental Requirements:

    a. 24 VAC with local transformer power
    b. The controllers shall also function normally under ambient conditions of 32 ˚F [0 ˚C] to 122 ˚F [50 ˚C] and 0% to 90% RH (non-condensing).
    c. Provide each controller with a suitable cover or enclosure to protect the intelligence board assembly.

9. Code Compliance:

    a. “FIPS 140-2 Level 1 Compliant” cryptographic module
    b. BACnet Testing Laboratory (BTL listed) using Device Profile BACnet Building Controller (B-BC) with outlined enhanced features.
    c. UL916 Energy management equipment
    d. FCC rules part 15, subpart B, class B
    e. UL94-V0 flammability rating

2.7 CONTROL PANELS

A. Indoor control cabinets located in offices or dry/dust free environments shall be fully enclosed NEMA 1 Type construction with hinged door, and removable sub-panels or electrical sub-assemblies.

B. All outdoor control cabinets and control cabinets located in mechanical/electrical rooms shall be NEMA 4.

C. Control panels containing more than 4 controllers shall be provided with a terminal strip for field wiring. All control wiring inside the panel shall be between a terminal strip and controller inputs/outputs. All field control wiring shall be terminated at the terminal strip. Field control wiring inputs/outputs shall not be run directly to inputs/outputs of controller.

2.8 AUTOMATIC CONTROL DAMPERS

A. Provision of dampers shall be provided by another section of this specification (the BAS contractor shall only be responsible for providing actuators/end switches for control dampers).

2.9 VARIABLE FREQUENCY DRIVES (VFDS)

A. Provision of variable frequency drives shall be provided by another section of this specification (the BAS contractor shall only be responsible for providing associated low voltage wiring and controls programming for the VFDs).

2.10 AUXILIARY CONTROL DEVICES, SENSORS, AND TRANSMITTERS

A. Air Flow Measuring Station

1. Features:
    a. Duct Air Flow Measuring Station: Highly accurate thermal dispersion airflow and temperature measuring probe(s) designed for duct sizes 8 – 120”. Multiple velocity and temperature points on one or more probes installed in the duct or plenum are averaged to arrive at air measurements. Capable of displaying the flow and temperature at each sensing point. Moisture resistant flex sensors protected from the elements with a thin conformal coating. Includes airfoil-Shaped aluminum probes with LCD screen digital display controller and the correct number of ancillary probes based on the size of the duct.
    b. Fan Inlet Air Flow Measuring Station: Shall be capable of monitoring and reporting the airflow and temperature at each fan inlet location scheduled through two or four sensing circuits and a control transmitter that communicates with the building automation system (BAS). Includes aerodynamically shaped, surface mount fan inlet sensors and LCD screen control transmitter.

2. Operating Temperature: -20° F to 120° F (-29° C to 49° C)
3. Protection / Rating: U.L. 94 flame rated, high impact ABS
4. Input/Output:

    a. Velocity Output : 4-20mA or 2-10 VDC with 500 ohm resistor
    b. Temperature Output : 4-20mA or 2-10 VDC with 500 ohm resistor
    c. BACnet MS/TP (for duct air flow measurement stations)

5. Power: 24 VAC (+/- 15%); 15 VA
6. Accuracy: ±3% of reading with ±0.25% repeatability and ±0.10° F (0.06˚ C)
7. Range: 0-5000 FPM for ducts and 0-10,000 FPM for fan-inlet
8. Agency Approvals: All components are U.L. Listed and compliant with RoHS directive 2002/95/EC, AMCA, and ISO 9001. In addition duct airflow measuring stations are compliant with Part 15 of the FCC rules and BTL.
9. Approved Manufacturer / Model:

    a. Duct Air Flow Measuring Station: Ebtron
    b. Fan Inlet Air Flow Measuring Station: Ebtron
    c. Other Approved Manufacturers: Upon Request

B. Air Pressure Sensor – Duct / Space / Air Differential (Filter/Coil Monitoring)

1. Features: Provide air pressure sensors as indicated within the sequences of operations and/or controls diagrams suitable for application. Select range as detailed below based on application type. Sensor shall include over pressure input protection of a minimum two times rated input or 20 psi (whichever is greater).

    a. Duct Mounted Static Pressure Sensor: Select range such that it covers from zero duct static pressure relative to the exterior of the duct up to a static pressure of between 20% and 50% in excess of the maximum static pressure that could be encountered in the duct relative to the duct exterior. Typically, for low pressure commercial duct consider using a range of 0 to 2” wc. (0 to 500Pa), for medium pressure duct use a range of 0 to 6” wc. (0 to 1500Pa) and for high-pressure duct use a range of 0 to 10” wc (0 to 2500 Pa).
    b. Space Static Pressure Sensor: Input range of -0.2” to + 0.2” wc (–50 to +50 Pa).
    c. Air Differential Pressure Sensor: Select range as required, taking into consideration pressure drop across filter or coil. Typically 0-2” wc (0 to 500 Pa) range for low-pressure commercial duct.

2. Operating Temperature: 32° F to 140° F (0° C to 60° C)
3. Protection / Rating: Polycarbonate (UL 94 V-0 Approved)
4. Input/Output: 4-20 mA, 0-5V, or 0-10V output proportional to pressure sensed
5. Power: 24VAC or 24VDC
6. Accuracy: ± 1% of full scale
7. Range: selectable pressure range 0- 20” w.c.
8. Agency Approvals: UL listed
9. Approved Manufacturer / Model:

a. Setra
b. Distech Controls

C. Air Pressure Switch

1. Features: Provide air pressure switches as indicated within the sequences of operations and/or controls diagrams suitable for application. Select range as required, taking into consideration pressure drop across filter or coil. Typically 0.2-2" wc (0 to 500pa) range for low-pressure commercial duct. Sensor shall include over pressure input protection of a minimum two times rated input or 20 psi (whichever is greater).
2. Operating Temperature: -4° F to 140° F (-20° C to 60° C)
3. Protection / Rating: IP54 (NEMA 13) polycarbonate
4. Input/Output: SPDT switch digital input from dry contact closure
5. Power: N/A
6. Accuracy: ± 1% of full scale
7. Range: selectable pressure range 0- 12" w.c.
8. Agency Approvals: N/A
9. Approved Manufacturer / Model:

a. Setra
b. Distech Controls

D. Carbon Dioxide (CO2) Sensor

1. Features: Provide a space or duct carbon dioxide gas detection sensor as indicated within the sequences of operations and/or control diagrams. Optional features include BACnet communication, LCD display, setpoint adjustment, or integral temperature/humidity sensors (optional features shall be provided if necessary based on project scope).
2. Operating Temperature: 32° F to 122° F (0° C to 50° C)
3. Input/Output: 4-20 mA, 0-10 or 0-5 Vdc output compatible with BMS proportional to carbon dioxide concentration
4. Power: 24VAC or 24VDC
5. Accuracy: ± 3% of full scale
6. Range: 0 to 2000 ppm

E. Duct / Immersion / Outdoor Temperature Sensors

1. Features: Provide Thermistor or RTD temperature sensors as indicated within the sequences of operations and/or control diagrams. Install sensor as detailed below.

a. Outside Air Temperature Sensor: Provide outside air temperature sensors with Aluminum LB with PVC sun and windscreen weatherproof enclosure with conduit entrance. Install in an area where exhaust or roof heat will not affect readings.

b. Duct Mounted Temperature Sensor (ducts less than $10ft^2$ [$1m^2$] in cross-sectional area): Provide duct mounted, single point probe temperature sensor with 0.25" [6.35 mm] stainless steel probe of length between one-third and two-thirds of the duct width.
c. Duct Mounted Averaging Temperature Sensor (ducts greater than $10ft^2$ [$1m^2$] in cross-sectional area): Provide duct mounted, averaging, temperature sensor with probe length of 12 feet [3.66m] minimum or 1ft per ft^2 (3.25m per m^2) of duct cross-sectional area, whichever is greater. Copper sheathed or plenum rated flexible construction.
d. Liquid Temperature Sensor: Provide immersion thermowell mounted temperature sensors for liquid temperature sensing. Rigid 0.25" [6.35mm] stainless steel probe of length, which is, at minimum, 20% of the pipe width. Provide Brass or Stainless steel thermowell (316 or 304) with thermal grease to aid temperature sensing.
e. Strap-on Temperature Sensor: Provide strap-on mounted temperature sensors where thermo well mounted sensors cannot be mounted.

2. Operating Temperature: -58° F to 212° F (-50° C to 100° C) dependent upon application
3. Input/Output: thermistor or RTD compatible with BAS
4. Power: dependent upon sensor type – provide as per manufacturers recommendations
5. Accuracy: ± 1.0°F (0.5 °C)
6. Range: -58° F to 212° F (-50° C to 100° C) dependent upon application

F. Duct / Outdoor Humidity Sensors

1. Features: Provide duct / outdoor humidity sensors as indicated within the sequences of operations and/or control diagrams. Outside air humidity sensors shall have ABS hinged weatherproof housing with conduit entrance and shall be installed in an area where exhaust or roof heat will not affect readings. Duct humidity sensors shall have ABS housing with conduit entrance. In addition all humidity sensors shall have 9" probe length, 60 micron HDPE filter, reverse voltage protection, and be output limited.
2. Operating Temperature: 32° F to 122° F (0° C to 50° C)
3. Input/Output: 4-20 mA two wires, 0-10 Vdc and/or 0-5 Vdc output proportional to relative humidity range of 0% to 100%
4. Power: 24VAC or 24VDC
5. Accuracy: ± 3% of full scale
6. Range: 5-95%RH

G. Space Temperature Sensors

1. Features: Provide space temperature sensors as indicated within the sequences of operations and/or control diagrams. Shall consist of an element within a ventilated cover. Space sensors located in mechanical rooms and large public spaces shall have no ability to adjust temperature setpoint (Set Point Adjustment). Space sensors located in other spaces shall include options (setpoint adjustment, network jack, fan speed selection, override switch, and/or digital display) in accordance with the drawings and sequences of operations.
2. Operating Temperature: 32° F to 122° F (0° C to 50° C)
3. Input/Output: dependent upon sensor type – provide as per manufacturers recommendations
4. Power: dependent upon sensor type – provide as per manufacturers recommendations
5. Accuracy: ± 1.0°F (0.5 °C)
6. Range: 32° F to 122° F (0° C to 50° C)

H. Space Humidity Sensors

1. Features: Provide space humidity sensors as indicated within the sequences of operations and/or control diagrams. Sensor shall have reverse voltage protection and be output limited.
2. Operating Temperature: 32° F to 122° F (0° C to 50° C)
3. Input/Output: dependent upon sensor type – provide as per manufacturers recommendations
4. Power: dependent upon sensor type – provide as per manufacturers recommendations
5. Accuracy: ± 3% of full scale
6. Range: 5-95%RH

I. Combination Relative Humidity And Temperature Sensors

1. Where there is a requirement for the monitoring of both relative humidity and temperature at the same location, the BMS Contractor shall provide a combination relative humidity sensor and temperature sensor. The individual sensors must each meet the specifications details above.

J. Low Limit Thermostats

1. Features: Provide low limit thermostats as indicated within the sequences of operations and/or control diagrams. Safety low limit thermostats shall be vapor pressure type with an element 20 ft [6.1 m] minimum length. Element shall respond to the lowest temperature sensed by any one foot section. Low limit shall be manual reset only.
2. Operating Temperature: -60° F to 160° F (-51° C to 71° C)
3. Input/Output: 2 SPDT switches, digital inputs from dry contact closure
4. Power: N/A
5. Accuracy: ± 1.0°F (0.5 °C)
6. Range: adjustable range 34° F to 70° F (1° C to 21° C)

K. Current Relay/Switch

1. Features: Provide current sensing relays as indicated within the sequences of operations and/or control diagrams. The current sensing relay shall be rated for the applicable load, shall have input and output isolation via current transformer, and the output relay shall have an accessible trip adjustment over its complete operating range. Whenever the status of a single speed motor is monitored it shall be done via a current sensing relay. The BAS contractor shall provide current sensing relays at the MCC starters (or at the local starter for motors without a MCC starter).
2. Operating Temperature: 5° F to 140° F (-15° C to 60° C)
3. Input/Output:digital input from dry contact closure
4. Power: Current relay shall be self-powered with no insertion loss
5. Accuracy: ± 2% of full scale

L. Current Sensor

1. Features: Provide current sensors as indicated within the sequences of operations and/or control diagrams. The current sensors shall be rated for the applicable load and shall be reverse polarity protected and output limited.
2. Operating Temperature: -20° F to 120° F (-29° C to 49° C)
3. Input/Output:4-20 mA, 0-10 or 0-5 Vdc output proportional to current draw
4. Power: Current sensor shall be self-powered with no insertion loss
5. Accuracy: ± 1% of full scale

M. Damper End Switch

1. Features: Provide damper end switches as indicated within the sequences of operations and/or control diagrams. End switches shall prove a damper has reached the position specified. End switches shall be integral to damper actuator unless otherwise specified.
2. Input/Output: SPDT switch, digital input from dry contact closure

N. Wireless Space Sensors / Switches

1. Provide for wireless sensing of the designated sensors and or switches as shown on the Point List Chart.
2. Wireless sensors shall be able to operate at a designated frequency of 315 MHz or 868 MHz, to be determined local regulation.
3. Controllers shall be field upgradable to receive wireless communications from switches and sensors (become wireless-enabled) by connecting a plug-in wireless transceiver.
4. Wireless temperature sensor/switch – the wireless sensing technology provided shall transmit a RF message indicating the value or position of the sensor. The transmission range shall be a minimum of 305 ft. [100 m] unobstructed line of sight and 100 ft. [30 m] in buildings.

5. Each sensor or switch shall be provided with energy harvesting technology such that no battery will be required to maintain normal operations. If using a Solar Cell for energy harvesting, normal operation parameters shall be defined as a minimum of 4 hours of 200lx of light to produce an operation of the sensor for a period of no less than 20 hours in total darkness. In sufficient light levels are not available, provide a battery backup.
6. All sensor locations shall be verified to be in compliance with manufacturer's installation requirements and be tested for acceptable signal strength.

PART 3 - EXECUTION

3.1 EXAMINATION

A. The contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the engineer for resolution before rough-in work is started.

3.2 INSTALLATION

A. Install controls so that adjustments and calibrations can be readily made. Controls are to be installed by the control equipment manufacturer.

B. Unless otherwise noted, install wall mounted thermostats and humidistat 60" above the floor measured to the center line of the instrument, or as otherwise directed by the Architect.

C. Install averaging elements in ducts and plenums in horizontal crossing or zigzag pattern.

D. Install damper motors on outside of duct in protected areas, not in locations exposed to outdoor temperatures.

E. Furnish hydronic instrument wells, valves, and other accessories to the mechanical contractor for installation.

F. Furnish automatic dampers to mechanical contractor for installation.

3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. BAS manufacturer shall be responsible for all BAS and Temperature Control wiring for a complete and operable system. All wiring shall be provided in accordance with all local and national codes and as described below:

1. All wiring associated with the installation will be the responsibility of this Contractor, unless otherwise directed herein.. The term "wiring" is construed to include furnishing of wire, conduit, miscellaneous material and labor as required, to install a total working system.
2. All low voltage (30V and below) wiring above accessible, concealed and dry locations may be run in plenum-rated cable without conduit (must be independently supported every 5 feet with bridle rings or other method approved by the consulting engineer). All low voltage wiring in mechanical spaces or electric/telephone closets must be run in electric metallic tubing (EMT), 3/4-inch or greater. All indoor wiring 30vac or greater shall be run in EMT conduit. All outdoor wiring shall be run in rigid metallic conduit. Seal tight may be used within 6 feet of the final connection to the device or panel.
3. This contractor shall be responsible for power that is not shown on the electrical drawings, to controls furnished by this contractor.
4. Wiring for controls furnished by others:

    a. Provide control wiring for HVAC controls furnished by others. Wiring may include, but not limited to, the following items:

        1) Thermostats
        2) Interlock wiring between split system AC units and their associated condensing unit
        3) Boiler control devices shipped loose

3.4 START-UP AND COMMISSIONING

A. When installation of the system is complete, calibrate equipment and verify transmission media before system is placed on-line. All testing, calibrating, adjusting, and final field tests shall be completed by the BAS contractor.

B. Perform a two-phase commissioning procedure consisting of field I/O calibration and overall system sequence of operation commissioning. Document that each point was verified and operating correctly on commissioning sheets, which shall be submitted prior to acceptance testing. The commissioning must be coordinated with the owner and construction manager to ensure systems are available when needed.

3.5 PROJECT RECORD DOCUMENTS

A. Operating manual to serve as training and reference manual for all aspects of day-to-day operation of the system. As a minimum include the following:

1. Complete as-built installation drawings for each building system.
2. Parts list with manufacturer's catalog numbers and ordering information.
3. Manufacturer's catalog literature for each piece of equipment.
4. Sequence of operation for automatic and manual operating modes for all building systems.

3.6 TRAINING

A. During System commissioning and at such time as acceptable performance of the Building Automation System hardware and software has been established, the BAS contractor shall provide on-site operator instruction to the owner's operating personnel. Operator instruction during normal working hours shall be performed by a competent building automation contractor representative familiar with the Building Automation System's software, hardware and accessories.

B. At a time mutually agreed upon, during System commissioning as stated above, the BAS contractor shall give 8-hours of onsite training on the operation of all BAS equipment. Describe its intended use with respect to the programmed functions specified. Operator orientation of the automation system shall include, but not be limited to:

1. Explanation of drawings and operator's maintenance manuals.
2. Walk-through of the job to locate all control components.
3. DDC Controller operation/sequence.
4. Operator control functions including scheduling, alarming, and trending.
5. Explanation of adjustment, calibration and replacement procedures.

END OF SECTION 23.0923

SECTION 23.0993 - HVAC CONTROL SEQUENCE

PART 1 - GENERAL

1.1 DESCRIPTION OF THE WORK:

A. Control Sequence is hereby defined to mean the manner in which, and methods by which, the automatic temperature controls function. The requirements for each type of operation are specified in this section.

B. The operation equipment, devices and system components required for the automatic temperature control system are specified in Section 230923 of these specifications.

1.2 SUBMITTALS:

A. Refer to Submittal Section in Section 230923 for additional information.

B. General: Submittals on temperature control work are required for shop drawings, manufacturer's data, operating instructions, maintenance manuals, wiring diagrams and the system guarantee and product warranties.

1.3 RELATED SECTIONS:

A. Section 230923 – Direct Digital Control (DDC).

B. Refer to the requirements of Division 1 and coordinate the division of responsibility of the work with Section 01 1000 – Summary of the Project.

PART 2 – CONTROLS

2.1 HIGH EFFICIENCY GAS-FIRED BOILER HEATING PLANT:

A. General: The boilers shall be fired in sequence by the boiler control system provided by the boiler manufacturer. The BAS shall integrate to the boiler control system so that all available points are displayed on the BAS.

B. The hot water plant shall be enabled by the BAS and shall run continuously.

C. When the heating plant is enabled, the lead pump shall energize and operate continuously. The BAS shall modulate the speed of the lead pump to maintain the differential pressure setpoint as determined during balancing. Differential pressure shall be monitored at (1) location in the building.

D. The boilers shall modulate to maintain a supply water temperature of 140°F (adj.) when the outside air temperature is below 30°F (adj.) and a temperature of 110°F (adj.) when the outside air temperature is above 60°F (adj.). If outside air temperature is between 30°F (adj.) and 60°F (adj.) the supply water temperature shall be ramped linearly between 140°F (adj.) and 110°F (adj.).

E. Whenever a boiler module fires, its associated boiler circulator pump shall energize.

F. In addition to the information available from the boiler control system. The hot water system supply water temperature, return water temperature, and pump speeds shall be displayed on the BAS.

2.2 CARBON MONOXIDE SENSOR:

A. Provide a carbon monoxide sensor in the boiler room. Sensor shall generate a local audible and visual alarm. Generate an alarm on the BAS should carbon monoxide be sensed.

2.3 NATURAL GAS SENSOR:

A. Provide a natural gas sensor in the boiler room. Sensor shall generate a local audible and visual alarm. Generate an alarm on the BAS should natural gas be sensed. Shut down all gas fired equipment if a leak is detected.

2.4 BURNER KILL SWITCHES:

A. Provide one (2) burner kill switches. When switch is switched to the off position the boilers shall be de-energized and an alarm shall be generated on the BAS.

2.5 LEAD/LAG SELECTION OF HOT WATER PUMP PAIRS:

A. Upon lead pump failure as sensed by the sensor for pump status, and after an adjustable time delay, the lag pump shall be energized and the lead pump shall be locked out through the VFD. An alarm message shall be generated on the BAS. Pump commands and lead pump selection shall be available throughout the network. Lead/lag selection shall be alternated by the Building Automation System on a weekly basis.

2.6 OCCUPIED-UNOCCUPIED CYCLES:

A. A direct digital controller shall provide the automatic signals for occupied or unoccupied control. For each zone listed below, provide a software graphical user interface that allows authorized maintenance personnel to select or override the automatic signals for occupied or unoccupied control on the Building Automation System (BAS) user interface. An alarm shall be generated on the BAS when the Zone is selected as "Override". Provide a separate zone for each energy recovery unit and rooftop air handling unit. Zone names to be coordinated with the Owner and Engineer.

B. Whenever any zone is indexed to occupied cycle, the unit or units shall run continuously and shall be controlled as specified hereinafter. In addition, any exhaust fans within the zone shall be indexed to occupied cycle. When indexed to the unoccupied cycle, the room sensors shall be reset to night temperature and shall cycle their respective units to maintain the setback or setup setpoints. During this cycle all associated exhaust fans shall be stopped and all associated outdoor and relief dampers shall be closed.

C. The automatic occupied - unoccupied signals shall incorporate an adaptive optimum start algorithm that shall utilize both the zone temperature and the outside air temperature to start the mechanical equipment to reach occupied temperature targets just in time for occupancy.

2.7 WARM-UP OR COOL-DOWN CYCLE:

A. For all air handlers, provide the necessary devices required to keep the outside air dampers closed during the warm-up and cool-down cycles prior to occupancy as determined by the optimum start algorithm.

2.8 PACKAGED MULTIPLE ZONE ENERGY RECOVERY UNIT

A. Units are equipped with supply air fans, exhaust fans, energy recovery w/ bypass dampers, outside air/return air dampers, DX cooling, hot gas reheat, natural gas furnace, and airflow monitoring.

B. Units shall be equipped with a factory provided controller with built-in sequences of operation. The controller shall be capable of the following modes of operation:

1. Occupied/Unoccupied Mode
2. Warm-Up/Cool-Down Mode
3. Cooling Mode
4. Heating Mode
5. Economizer Mode via Comparative Enthalpy
6. Dehumidification

C. The Building Automation System (BAS) shall interface with the controller so that all available points (including alarms) are on the BAS. The following points shall be displayed on the BAS: outside airflow, return air temperature/humidity, energy recovery bypass damper positions, outside/return damper positions, filter status, mixed air temperature/humidity, compressor status, hot gas reheat status, gas heating status and stage, exhaust fan status and speed, supply fan status and speed, and supply air temperature/humidity.

D. The BAS shall command the unit to occupied or unoccupied modes and shall control the discharge supply air temperature. The BAS shall monitor and reset the unit discharge supply air temperature to satisfy the room with the largest cooling demand.

E. Discharge Air Temperature Reset Control:

1. At a frequency of once every 10 minutes, the BAS shall monitor the outdoor dry-bulb temperature, as well as the zone temperature and damper position of all VAV terminal units.
2. The BAS shall calculate a new SAT set-point based on current outdoor air (OA) temperature, and send this newly-calculated SAT setpoint to the AHU controller.
3. When the OA temperature is warmer than 65°F (adj), the SAT set-point shall be 55°F (adj).
4. When the OA temperature is colder than 55°F (adj), the SAT set-point shall be 65°F (adj).
5. When the OA temperature is between 55°F (adj) and 65°F (adj), the SAT set-point shall be reset proportionally between 55°F (adj) and 65°F (adj).
6. If at least two (adj) zones have both 1) a VAV damper that is more than 75% open, and 2) a current zone temperature that is higher than the current cooling set-point, then the SAT set-point shall return to 55°F (adj).
7. If the outdoor dew point is higher than 60°F (adj), this SAT Reset sequence shall be suspended and the SAT set-point shall be reset to 55°F (adj) until outdoor dew point drops below 57°F (adj).
8. If return humidity rises above 50% (adj.), the unit will ignore any discharge air temperature reset sequence and discharge a constant 55°F (adj.).
9. Once return air humidity drops 5% below set-point the unit can follow the discharge air temperature reset sequences that are outlined.

F. Safeties: For units with capacity greater than or equal to 2000 CFM, duct smoke detector(s) shall be provided. Power wiring to duct detector(s) shall be provided by the Electrical Contractor and control shutdown wiring shall be provided by this contractor. Upon sensing the products of combustion, the fan shall be de-energized, the outside air damper shall be closed, the heating and cooling shall be off and an alarm message shall be generated on the Building Automation System.

2.9 PACKAGED MULTIPLE ZONE VAV ROOFTOP UNIT:

A. Units are equipped with supply air fans, outside air/return air dampers, DX cooling, hot gas reheat, natural gas furnace, and airflow monitoring.

B. Units shall be equipped with a factory provided controller with built-in sequences of operation. The controller shall be capable of the following modes of operation:

1. Occupied/Unoccupied Mode
2. Warm-Up/Cool-Down Mode
3. Cooling Mode
4. Heating Mode
5. Economizer Mode via Comparative Enthalpy
6. Dehumidification

C. The Building Automation System (BAS) shall interface with the controller so that all available points (including alarms) are on the BAS. The following points shall be displayed on the BAS: outside airflow, return air temperature/humidity, outside/return damper positions, filter status, mixed air temperature/humidity, compressor status, hot gas reheat status, gas heating status and stage, supply fan status and speed, and supply air temperature/humidity.

D. The BAS shall command the unit to occupied or unoccupied modes and shall control the discharge supply air temperature. The BAS shall monitor and reset the unit discharge supply air temperature to satisfy the room with the largest cooling demand.

E. Discharge Air Temperature Reset Control:

1. At a frequency of once every 10 minutes, the BAS shall monitor the outdoor dry-bulb temperature, as well as the zone temperature and damper position of all VAV terminal units.
2. The BAS shall calculate a new SAT set-point based on current outdoor air (OA) temperature, and send this newly-calculated SAT setpoint to the AHU controller.
3. When the OA temperature is warmer than 65°F (adj), the SAT set-point shall be 55°F (adj).
4. When the OA temperature is colder than 55°F (adj), the SAT set-point shall be 65°F (adj).
5. When the OA temperature is between 55°F (adj) and 65°F (adj), the SAT set-point shall be reset proportionally between 55°F (adj) and 65°F (adj).
6. If at least two (adj) zones have both 1) a VAV damper that is more than 75% open, and 2) a current zone temperature that is higher than the current cooling set-point, then the SAT set-point shall return to 55°F (adj).
7. If the outdoor dew point is higher than 60°F (adj), this SAT Reset sequence shall be suspended and the SAT set-point shall be reset to 55°F (adj) until outdoor dew point drops below 57°F (adj).
8. If return humidity rises above 50% (adj.), the unit will ignore any discharge air temperature reset sequence and discharge a constant 55°F (adj.).
9. Once return air humidity drops 5% below set-point the unit can follow the discharge air temperature reset sequences that are outlined.

F. Safeties: For units with capacity greater than or equal to 2000 CFM, duct smoke detector(s) shall be provided. Power wiring to duct detector(s) shall be provided by the Electrical Contractor and control shutdown wiring shall be provided by this contractor. Upon sensing the products of combustion, the fan shall be de-energized, the outside air damper shall be closed, the heating and cooling shall be off and an alarm message shall be generated on the Building Automation System.

2.10 PACKAGED SINGLE ZONE ROOFTOP UNIT

A. Units are equipped with supply air fans, outside air/return air dampers, DX cooling, hot gas reheat, natural gas furnace, and airflow monitoring.

B. Units shall be equipped with a factory provided controller with built-in sequences of operation. The controller shall be capable of the following modes of operation:

1. Occupied/Unoccupied Mode
2. Warm-Up/Cool-Down Mode
3. Cooling Mode
4. Heating Mode
5. Economizer Mode via Comparative Enthalpy
6. Dehumidification

C. The Building Automation System (BAS) shall interface with the controller so that all available points (including alarms) are on the BAS. The following points shall be displayed on the BAS: outside airflow, return air temperature/humidity, outside/return damper positions, filter status, mixed air temperature/humidity, compressor status, hot gas reheat status, gas heating status and stage, supply fan status and speed, and supply air temperature/humidity.

D. The BAS shall command the unit to occupied or unoccupied modes.

E. Safeties: For units with capacity greater than or equal to 2000 CFM, duct smoke detector(s) shall be provided. Power wiring to duct detector(s) shall be provided by the Electrical Contractor and control shutdown wiring shall be provided by this contractor. Upon sensing the products of combustion, the fan shall be de-energized, the outside air damper shall be closed, the heating and cooling shall be off and an alarm message shall be generated on the Building Automation System.

2.11 SHUTOFF VAV BOX CONTROL (VAV):

A. The VAV box is to be controlled independent of system pressure fluctuations by an application specific DDC controller using electric actuation. The space served by the VAV box is controlled in Occupied and Unoccupied as indexed by the BAS according to its respective zone signal.

B. During the Occupied cycle, the VAV box primary air damper is controlled within user defined occupied maximum and minimum supply air volume settings. The controller monitors the room temperature sensor and air velocity sensor and modulates the primary supply air damper in sequence with the reheat valve to maintain the room temperature at setpoint. While the reheat coil is being utilized for heating, the box primary supply damper shall remain at the minimum design CFM. Where a terminal heating unit (radiation, cabinet heaters, etc.) occurs in the same space, the terminal heating unit shall serve as the first stage of heat and the VAV box shall discharge room neutral air at the minimum supply air volume setpoint.

C. During the unoccupied cycle the VAV box primary air damper shall be allowed to be fully closed.

D. Room Sensors:

1. All sensor inputs and actuator outputs from the controller shall be available throughout the Building Automation System.

2.12 EXHAUST FAN:

A. Those exhaust fans noted "ATC" on the Exhaust Fan schedule shall run during occupied cycle and remain off during unoccupied cycle of their respective zone. The exhaust fans shall be controlled via spare binary outputs of local DDC controllers such that they can be overridden on/off through the Building Automation System.

B. Those exhaust fans noted "T-STAT" on the schedule shall be controlled based upon a space temperature sensor via the DDC system. Upon a rise in space temperature, the exhaust fan shall run and any associated intake or exhaust dampers shall open (where applicable). On a fall in space temperature, the reverse shall occur.

C. Those exhaust fans noted "CO / NO2" on the schedule shall be controlled based upon a space carbon monoxide and nitrogen dioxide sensors via the DDC system. Upon a rise in acceptable levels, the exhaust fan shall run and any associated intake or exhaust dampers shall open (where applicable). On a fall in CO & NO2 levels, the reverse shall occur.

2.13 CEILING FAN:

A. BAS shall interface with fan controller. Fans shall be indexed to the occupied/ unoccupied modes from the BAS along with its respective zone. In occupied mode the fan shall run continuously at its minimum speed. In unoccupied mode the fan shall remain off.

2.14 CABINET UNIT HEATER AND UNIT HEATER:

A. Provide a space temperature sensor for control of each cabinet unit heater. The sensor shall be controlled through the BAS and be indexed to occupied or unoccupied cycle based upon its respective zone signal. The sensor shall cycle the cabinet heater fan to maintain the day or night temperature setpoint. Any time that the unit fan is energized, the two position hot water control valve shall open.

2.15 CONVECTOR:

A. Provide a space temperature sensor for control of each convector. The sensor shall be indexed to occupied or unoccupied cycle from the BAS based upon its respective zone signal. The sensor shall modulate the heating valve to maintain the day or night temperature setpoint.

2.16 ELECTRIC BASEBOARD RADIATION:

A. Unit shall be controlled through manufacturer integral thermostat.

2.17 DUCTLESS SPLIT SYSTEM AIR CONDITIONING UNIT:

A. Unit shall be controlled through manufacturer supplied remote thermostat. Install and wire the thermostat provided by the unit manufacturer.

B. Provide a space temperature sensor in each space and indicate an alarm on the BAS if abnormal temperatures are sensed.

2.18 INFRARED TUBE HEATER:

A. Each heater shall be controlled through a remote thermostat. Upon a drop in space temperature, below setpoint, the 1st stage of heating shall be energized. On a continued drop is space temperature, after a time delay, the 2nd stage of heating shall be energized. The heater shall be de-energized when the space temperature is about the temperature setpoint.

2.19 EMERGENCY GENERATOR:

A. Interface with the generator system via BACnet gateway supplied by ATC contractor and indicate status and any failure or trouble alarms on the BAS.

B. Interface with the (2) automatic transfer switches (ATS) and indicate position on the BAS.

2.20 DOMESTIC HOT WATER HEATER:

A. Interface with the water heater via BACnet gateway supplied by ATC contractor and indicate storage temperature and any failure or trouble alarms on the BAS.

2.21 DOMESTIC WATER RECIRCULATION PUMP:

A. Domestic water recirculation pumps shall be monitored and controlled by the BAS. Pumps shall be commanded on/off based on the building occupancy schedule. The pump shall energize 2 hours (adj.) before the occupancy start time and de-energize when the building is unoccupied. An alarm shall be generated on the BAS if a pump fails to start.

2.22 ELEVATOR SUMP PIT HIGH WATER LEVEL ALARM:

A. Provide a water level sensor or float switch to monitor the elevator sump pit water levels and indicate an alarm on the BAS upon sensing a high water condition.

2.23 ENERGY MONITORING:

A. Interface with KWH meter within the switchboard via BACnet gateway supplied by ATC contractor. BAS shall indicate instantaneous power consumption and cumulative daily power consumption for a period of 1 year.

2.24 LIGHTING CONTROLS:

A. Interface with the lighting control panel via BACnet IP. BAS shall display status and be able to write/override schedules for interior corridor and exterior lighting zones.

2.25 HEAT TRACE:

A. Provide a current sensing relay on each heat trace circuit to indicate status on the BAS.

2.26 THERMOSTAT GUARDS:

A. Provide stainless steel covers over temperature sensors located in Engine and EMS Bays.

2.27 ALARMING:

A. Any alarm that the Owner defines as critical shall initiate an alarm to the remote Operator Workstation and shall generate an alarm message there. Utilize the Building's Ethernet communications and data system.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Refer to the 230923 section of these specifications.

3.2 TEST-ADJUST-BALANCE (TAB) COORDINATION AND ASSIST:

A. Include all labor for coordination and assistance to the TAB contractor for final system testing, adjusting and balancing.

END OF SECTION 23.0993

SECTION 23.2113 - HYDRONIC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Hydronic system requirements.

B. Heating water piping, above grade.

C. Equipment drains and overflows.

D. Pipe hangers and supports.

E. Unions, flanges, mechanical couplings, and dielectric connections.

F. Valves:

1. Gate valves.
2. Ball valves.
3. Butterfly valves.
4. Check valves.

1.2 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 08 3100 - Access Doors and Panels.

C. Section 09 9000 - Painting and Coating.

D. Section 23 0516 - Expansion Fittings and Loops for HVAC Piping.

E. Section 23 0553 - Identification for HVAC Piping and Equipment.

F. Section 23 0719 - HVAC Piping Insulation.

G. Section 23 2114 - Hydronic Specialties.

H. Section 23 2500 - HVAC Water Treatment: Pipe cleaning.

1.3 REFERENCE STANDARDS

A. ASME (BPV IX) - Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications; The American Society of Mechanical Engineers; 2010.

B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; The American Society of Mechanical Engineers; 2011.

C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2012 (ANSI B16.18).

D. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; 2001 (R2010).

E. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2010.

F. ASME B31.9 - Building Services Piping; 2011 (ANSI/ASME B31.9).

G. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

H. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2011a.

I. ASTM A312/A 312M; - Standard specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipe 2006.

J. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2009).

K. ASTM B32 - Standard Specification for Solder Metal; 2008.

L. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2009.

M. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2005 (Reapproved 2011).

N. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2012.

O. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications; 2012.

P. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2009.

Q. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2006.

R. ASTM D2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80; 2006.

S. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings; 1996 (Reapproved 2010).

T. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992 (Reapproved 2008).

U. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications; 2007.

V. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2010.

W. AWWA C606 - Grooved and Shouldered Joints; 2011 (ANSI/AWWA C606).

X. MSS SP-58 - Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2009.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Welders Certificate: Include welders certification of compliance with ASME (BPV IX).

1. Provide weld test results.

C. Product Data:

1. Include data on pipe materials, pipe fittings, valves, and accessories.
2. Provide manufacturers catalogue information.
3. Indicate valve data and ratings.
4. Show grooved joint couplings, fittings, valves, and specialties on drawings and product submittals, specifically identified with the manufacturer's style or series designation.

D. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

E. Project Record Documents: Record actual locations of valves.

F. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Valve Repacking Kits: One for each type and size of valve.

3. 1 spare valve handle for each type valve.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with minimum three years of experience.

C. Provide all grooved joint couplings, fittings, valves, specialties, and grooving tools from a single manufacturer.

D. Date stamp all castings used for coupling housings, fittings, valve bodies, etc. for quality assurance and traceability.

E. Coupling Manufacturer:

1. Perform on-site training by factory-trained representative to the Contractor's field personnel in the proper use of grooving tools and installation of grooved joint products.
2. Periodic job site visits by factory-trained representative to ensure best practices in grooved joint installation.

F. Welder Qualifications: Certify in accordance with ASME (BPV IX).

1. Provide certificate of compliance from authority having jurisdiction, indicating approval of welders.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves. Coating shall be as recommended and supplied by the valve manufacturer.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary plugs, completing sections of the work, and isolating parts of completed system. Temporarily cap or plug incomplete piping sections at the end of each day.

PART 2 PRODUCTS

2.1 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping: Provide piping, fittings, hangers and supports as required, as indicated, and as follows:

1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
3. Grooved mechanical joints may be used in accessible locations only.

    a. Accessible locations include those exposed on interior of building, in pipe chases, and in mechanical rooms, aboveground outdoors, and as approved by Architect.
    b. Grooved mechanical connections and joints comply with AWWA C606.

        1) Ductile Iron: Comply with ASTM A536, Grade 65-45-12.

    c. Use rigid joints unless otherwise indicated.

4. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise. Indicate all drawings and supports on the coordination drawings.

C. Valves: Provide valves where indicated:

1. Provide OS & Y gate valves for boiler isolation valves.
2. Provide drain valves where indicated, and if not indicated provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch ball valves with cap; pipe to nearest floor drain.
3. On discharge of condenser water pumps, use spring loaded check valves.
4. Isolate equipment using butterfly valves with lug end flanges or grooved mechanical couplings.

D. Welding Materials and Procedures: Conform to ASME (BPV IX).

2.2 HEATING WATER PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, using one of the following joint types. Use for piping diameters greater than 2":

1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1 welded.
2. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

B. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), drawn, using one of the following joint types. Use up to 2" size only:

1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.

a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

2. Copper Press Fittings (all pipe sizes): Shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM. Copper press fittings shall be EPDM. Copper press fittings shall be manufactured by Viega and installed utilizing Rigid Tool Company as "Pro Press System". Complete installation shall comply with manufacturers recommendations.
3. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.

2.3 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), drawn; using one of the following joint types:

1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

B. PVC Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26.

1. Fittings: ASTM D2466 or D2467, PVC.
2. Joints: Solvent welded in accordance with ASTM D2855.
3. Do not use PVC in air plenums.

2.4 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with Section 23 2117.

2.5 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

A. Unions for Pipe 2 Inches and Under:

1. Ferrous Piping: 150 psig malleable iron, threaded.
2. Copper Pipe: Bronze, soldered joints.
3. Unions are not required in installations using grooved mechanical joint couplings. (The couplings shall serve as unions and disconnect points.)

B. Flanges for Pipe Over 2 Inches:

1. Ferrous Piping: 150 psig forged steel, slip-on.

C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.

1. Dimensions and Testing: In accordance with AWWA C606.
2. Mechanical Couplings: Comply with ASTM F1476.
3. Housing Material: Ductile iron, galvanized or enamel coated complying with ASTM A536.
4. Gasket Material: EPDM suitable for operating temperature range from -30 degrees F to 230 degrees F.
5. Bolts and Nuts: Hot dipped galvanized.
6. When pipe is field grooved, provide coupling manufacturer's grooving tools.
7. Sizes through 12 Inches (300 mm):
    a. Rigid Type: Housings shall be cast with bolt pads to provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9.

        1) 2 (50 mm) through 12 Inches (300 mm): Installation-Ready, for direct stab installation without field disassembly, with grade EHP gasket rated to +250 deg F (+120 degrees C).

    b. Flexible Type: For use in locations where vibration attenuation and stress relief are required. Three flexible couplings may be used in lieu of a flexible connector. The couplings shall be placed in close proximity to the source of the vibration.

8. Manufacturers:

    a. Victaulic Company: www.victaulic.com.
    b. Anvil International: www.anvilintl.com.

D. Dielectric Connections:

1. Waterways:

    a. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
    b. Dry insulation barrier able to withstand 600 volt breakdown test.
    c. Construct of galvanized steel with threaded end, cast bronze with solder joint end, or grooved end connections to match connecting piping.
    d. Suitable for the required operating pressures and temperatures.

2.6 GATE VALVES

A. Manufacturers:

1. Conbraco Industries: www.conbraco.com.
2. Milwaukee Valve Company: www.milwaukeevalve.com.
3. Nibco, Inc: www.nibco.com.

4. Tyco Flow Control: www.tycoflowcontrol.com.
5. Jomar Valve: https://www.jomarvalve.com.

B. Over 2 Inches:

1. Iron body, bronze trim, bolted bonnet, rising stem, handwheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged ends.

2.7 BALL VALVES

A. Manufacturers:

1. Conbraco Industries: www.conbraco.com.
2. Grinnell Mechanical Products, a Tyco International Co: www.grinnell.com.
3. Milwaukee Valve Company: www.milwaukeevalve.com.
4. Nibco, Inc: www.nibco.com.
5. Tyco Flow Control: www.tycoflowcontrol.com.
6. Victaulic Company: www.victaulic.com.
7. Anvil International: www.anvilintl.com.
8. Jomar Valve: https://www.jomarvalve.com.

B. Up To and Including 2 Inches:

1. Bronze one piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder ends with union. Extended insulated handle for use with insulated piping.

2.8 BUTTERFLY VALVES

A. Manufacturers:

1. Crane Co.: www.cranevalve.com.
2. Grinnell Mechanical Products, a Tyco International Co: www.grinnell.com.
3. Hammond Valve: www.hammondvalve.com.
4. Milwaukee Valve Company: www.milwaukeevalve.com.
5. Tyco Flow Control: www.tycoflowcontrol.com.
6. Victaulic Company: www.victaulic.com.
7. Anvil International: www.anvilintl.com.
8. Jomar Valve: https://www.jomarvalve.com.

B. Body: Cast or ductile iron with resilient replaceable EPDM seat, lug or grooved ends, extended insulated neck for use with insulated piping.

C. Disc: Construct of ductile iron with EPDM enscapsulation.

D. Stem: Stainless steel with stem offset from the centerline to provide full 360 degree circumferential setting.

E. Operator: Infinite position lever handle with memory stop or gear operator. Provide gear operator for valves 6" size and larger.

2.9 SWING CHECK VALVES

A. Manufacturers:

1. Grinnell Mechanical Products, a Tyco International Co: www.grinnell.com.
2. Hammond Valve: www.hammondvalve.com.
3. Milwaukee Valve Company: www.milwaukeevalve.com.
4. Nibco, Inc: www.nibco.com.
5. Tyco Flow Control: www.tycoflowcontrol.com.
6. Victaulic Company: www.victaulic.com.
7. Anvil International: www.anvilintl.com.
8. Jomar Valve: https://www.jomarvalve.com.

B. Up To and Including 2 Inches:

1. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder ends.

C. Over 2 Inches:

1. Iron body, bronze trim, stainless steel swing disc, renewable disc and seat, flanged or grooved ends.

2.10 SPRING LOADED CHECK VALVES

A. Manufacturers:

1. Crane Co.: www.cranevalve.com.
2. Hammond Valve: www.hammondvalve.com.
3. Milwaukee Valve Company: www.milwaukeevalve.com.
4. Tyco Flow Control: www.tycoflowcontrol.com.
5. Victaulic Company: www.victaulic.com.
6. Anvil International: www.anvilintl.com.
7. Jomar Valve: https://www.jomarvalve.com.

B. Iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer or threaded lug ends.

C. Grooved End Valves:

1. Iron body through 12 Inches (300 mm), stainless steel spring and shaft, single-disc with elastomer coated ductile iron disc and welded-in nickel seat, or aluminum-bronze disc with EPDM seal and PPS coated seat.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Prepare pipe for grooved mechanical joints as required by coupling manufacturer.

C. Prepare piping connections to equipment using jointing system specified.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

E. After completion, fill, clean, and treat systems. Refer to Section 23 2500 for additional requirements.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install heating water to ASME B31.9 requirements. Install chilled water piping to ASME B31.5 requirements.

C. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

D. Route piping in orderly manner, parallel to building structure, and maintain gradient.

E. Install piping to conserve building space and to avoid interfere with use of space.

F. Group piping whenever practical at common elevations.

G. Sleeve pipe passing through partitions, walls and floors. Refer to Section 23 0501 and details.

H. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

I. Slope piping and arrange to drain at low points.

J. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 0516.

1. For water systems, use adequate numbers of flexible couplings in header piping to accommodate thermal growth and contraction, and for the elimination of expansion loops. (In accordance with manufacturer's instructions and as approved by the engineer.) Where expansion loops are required, use couplings on the loops. Submit Calculations from manufacturer to confirm deletion of expansion loops.
2. Flexible couplings may be used in header piping to accommodate thermal growth, thermal contraction in lieu of expansion loops.
3. Use flexible couplings in expansion loops.

K. Grooved Joints:

1. Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be of an elastomer grade suitable for the intended service, and shall be molded and produced by the coupling manufacturer. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review contractor is following best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or jobsite visit(s).)

L. Pipe Hangers and Supports:

1. Refer to Section 23 2117.
2. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-89.
3. Support horizontal piping as scheduled.
4. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
5. Place hangers within 12 inches of each horizontal elbow.
6. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
7. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
8. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
9. Provide copper plated hangers and supports for copper piping.
10. Prime coat all steel hangers and supports. Refer to Section 09 9000.

M. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 23 0719.

N. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 3100.

O. Use eccentric reducers to maintain top of pipe level.

P. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

Q. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting. Refer to Section 09 9000.

R. Install valves with stems upright or horizontal, not inverted.

3.3 INSPECTION:

A. General: Clean exterior surfaces of installed piping systems of superfluous materials and prepare for application of specified coatings if any. Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.

3.4 VALVE INSTALLATION:

A. General: Except as otherwise indicated, comply with the following requirements:

1. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.
2. Install valves with stems pointed up, in the vertical position, where possible, but in no case with stems pointed downward from a horizontal plane unless unavoidable. Install valve drains with hose-end adapter for each valve that must be installed with stem below horizontal plane.

B. Insulation: Where insulation is indicated, install extended stem valves, arranged in the proper manner to receive insulation.

3.5 SCHEDULES

A. Hanger Spacing for Copper Tubing.

1. 1/2 inch and 3/4 inch: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. 1 inch: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. 1-1/2 inch and 2 inch: Maximum span, 8 feet; minimum rod size, 3/8 inch.
4. 2-1/2 inch: Maximum span, 9 feet; minimum rod size, 3/8 inch.

B. Hanger Spacing for Steel Piping.

1. 1/2 inch, 3/4 inch, and 1 inch: Maximum span, 7 feet; minimum rod size, 1/4 inch.
2. 1-1/4 inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
3. 1-1/2 inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
4. 2 inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
5. 2-1/2 inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.

6. 3 inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.
7. 4 inches: Maximum span, 14 feet; minimum rod size, 1/2 inch.
8. 6 inches: Maximum span, 17 feet; minimum rod size, 1/2 inch.
9. 8 inches: Maximum span, 19 feet; minimum rod size, 5/8 inch.

C. Hanger Spacing for Plastic Piping.

1. 3/4 inch: Maximum span, 45 inches; minimum rod size, 1/4 inch.
2. 1 inch: Maximum span, 51 inches; minimum rod size, 1/4 inch.
3. 1-1/4 inches: Maximum span, 57 inches; minimum rod size, 3/8 inch.
4. 1-1/2 inches: Maximum span, 63 inches; minimum rod size, 3/8 inch.
5. 2 inches: Maximum span, 69 inches; minimum rod size, 3/8 inch.

END OF SECTION 23.2113

SECTION 23.2114 - HYDRONIC SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Expansion tanks.

B. Air vents.

C. Air separators.

D. Strainers.

E. Combination pump discharge valves.

F. Balancing valves.

G. Valve Installation Kits.

H. Relief valves.

I. Pressure reducing valves.

1.2 RELATED REQUIREMENTS

A. Section 23 2113 - Hydronic Piping.

B. Section 23 2500 - HVAC Water Treatment: Pipe Cleaning.

1.3 REFERENCE STANDARDS

A. ASME (BPV VIII, 1) - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; 2010.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description, model and dimensions.

C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

D. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.1 See Section 01 6000 for additional requirements.

2.2 EXPANSION TANKS

A. Manufacturers:

1. Amtrol Inc: www.amtrol.com.
2. Bell & Gossett: www.bellgossett.com.
3. Taco, Inc: www.taco-hvac.com.

B. Construction: Welded steel, tested and stamped in accordance with ASME (BPV VIII, 1); supplied with National Board Form U-1, rated for working pressure of 125 psi, with replaceable flexible butyl diaphragm, and steel support stand.

C. Accessories: Pressure gage and air-charging fitting, tank drain; precharge to 12 psi.

D. Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced pressure double check back flow preventer, test cocks, strainer, vacuum breaker, and valved by-pass.

2.3 AIR VENTS

A. Manufacturers:

1. Armstrong International, Inc: www.armstronginternational.com.
2. Bell & Gossett: www.bellgossett.com.
3. Taco, Inc: www.taco-hvac.com.

B. Float Type:

1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.
2. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.

2.4 AIR SEPARATORS

A. Combination Air Separators/Strainers:

1. Manufacturers:

a. Armstrong International, Inc: www.armstronginternational.com.
b. Bell & Gossett: www.bellgossett.com.
c. Taco, Inc: www.taco-hvac.com.

2. Steel, tested and stamped in accordance with ASME (BPV VIII, 1); for 125 psi operating pressure, with integral bronze strainer, tangential inlet and outlet connections, and internal stainless steel air collector tube.
3. Provide internal corrosion resistant coating.

2.5 STRAINERS

A. Manufacturers:

1. Armstrong International, Inc: www.armstronginternational.com.
2. Flexicraft Industries: www.flexicraft.com.
3. Grinnell Mechanical Products, a Tyco International Co: www.grinnell.com.
4. The Metraflex Company: www.metraflex.com.
5. Victaulic Company: www.victaulic.com.
6. Anvil International: www.anvilintl.com.

B. Size 2 inch and Under:

1. Screwed brass or iron body for 175 psi working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

C. Size 2-1/2 inch to 8 inch:

1. Provide flanged or grooved iron body for 175 psi working pressure, Y pattern with 3/64 inch stainless steel perforated screen.

2.6 COMBINATION PUMP DISCHARGE VALVES

A. Manufacturers:

1. Bell & Gossett Model 3DS: www.bellgossett.com.
2. Crane Co.: www.cranevalve.com.
3. Taco, Inc: www.taco-hvac.com.
4. Victaulic Company: www.victaulic.com.
5. Anvil International: www.anvilintl.com.

B. Valves: Straight or angle pattern, flanged cast-iron valve body with bolt-on bonnet for 175 psi operating pressure, non-slam check valve with spring-loaded bronze disc and seat, stainless steel stem, and calibrated adjustment permitting flow regulation.

2.7 BALANCING VALVES

A. Manufacturers:

1. Armstrong International, Inc: www.armstronginternational.com.
2. Bell & Gossett: www.bellgossett.com.
3. Oventrop Corporation: www.oventrop.com.
4. Victaulic Company: www.victaulic.com.
5. Anvil International: www.anvilintl.com.

B. Size 2 inch and Smaller:

1. Provide ball or globe style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and NPT threaded or soldered connections.
2. Metal construction materials consist of bronze or brass.
3. Non-metal construction materials consist of Teflon, EPDM, or engineered resin.

C. Size 2.5 inch and Larger:

1. Provide ball or butterfly style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and flanged, grooved, or weld end connections.
2. Valve body construction materials consist of cast iron or ductile iron.
3. Internal components construction materials consist of brass, aluminum bronze, bronze, Teflon, EPDM, NORYL, or engineered resin.

2.8 VALVE INSTALLATION KITS:

A. In lieu of individual valves, strainers, and balancing valves, valve installation kits are acceptable for use for pipe sizes up to 2".

B. Valve kits shall be as supplied by Bell & Gossett, Oventrop, Nexus, Nutech, Meleney Equipment, Inc. or approved equal.

C. Supply valve kits shall include combination wye strainer and shutoff valve with pressure temperature test port, drain valve, tailpiece, and union end.

D. Return valve kits shall include calibrated balance and shut off valve with two pressure temperature test ports, tail piece, and union end.

2.9 RELIEF VALVES

A. Manufacturers:

1. Tyco Flow Control: www.tycoflowcontrol.com.
2. Armstrong International, Inc: www.armstronginternational.com.
3. Bell & Gossett: www.bellgossett.com.
4. Conbraco Industries, Inc: www.conbraco.com.

B. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.10 PRESSURE REDUCING VALVES

A. Manufacturers:

1. Armstrong International, Inc: www.armstronginternational.com.
2. ITT Bell & Gossett: www.bellgossett.com.
3. Taco, Inc: www.taco-hvac.com.
4. Victaulic Company: www.victaulic.com.
5. Anvil International: www.anvilintl.com.

B. Operation: Automatically feeds make-up water to the hydronic system whenever pressure in the system drops below the pressure setting of the valve. Refer to Section 23 2113.

C. Materials of Construction:

1. Valve Body: Constructed of bronze.
2. Internal Components: Construct of stainless steel or brass and engineered plastics.

D. Provide integral check valve and strainer.

E. Maximum Inlet Pressure: 100 psi.

F. Maximum Fluid Temperature: 180 degrees F.

G. Operating Pressure Range: Between 10 psi and 50 psi.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install specialties in accordance with manufacturer's instructions.

B. Where large air quantities can accumulate, provide enlarged air collection standpipes. Provide in boiler room, chiller room, and pump rooms at air separators, and air handling mechanical equipment rooms at high points of piping systems.

C. Provide manual air vents at system high points and as indicated.

D. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

E. Provide valved drain and hose connection on strainer blow down connection. Provide caps with gaskets on discharge.

F. Provide combination pump discharge valve on discharge side of centrifugal pumps where indicated.

G. Support pump fittings with floor mounted pipe and flange supports.

H. Provide relief valves on pressure tanks, low pressure side of reducing valves, heat exchangers, and expansion tanks.

I. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

J. Pipe relief valve outlet to nearest floor drain.

3.2 MAINTENANCE

A. See Section 01 7000 - Execution Requirements, for additional requirements relating to maintenance service.

B. Explain corrective actions to Owner's maintenance personnel in person.

END OF SECTION 23.2114

SECTION 23.2117 - PIPE HANGERS, SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. This section specified hangers, supports and anchors for use in piping systems installed in other sections of these specifications.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Grinnell

B. Approved Equal.

2.2 HORIZONTAL PIPING HANGERS AND SUPPORTS:

A. General: Except as otherwise indicated, provide factory fabricated horizontal piping hangers and supports of the MSS type and size indicated, bolts (if any) and washers; comply with MSS SP-58 and the manufacturer's published product information. Where the MSS type or size is not indicated, provide proper selection determined by installer for installation requirements, and comply with MSS SP-69 and the manufacturer's published product information: size hangers and supports properly for piping including insulation, if any.

B. Adjustable Band Hangers: MSS Type 7, fabricated from steel.

C. Adjustable Swivel Band Hangers: MSS Type 10.

D. Clamp: MSS Type 4.

E. Double Bolt Clamp: MSS Type 3, including pipe spacers.

2.3 VERTICAL PIPING CLAMPS:

A. General: Except as otherwise indicated, provide factory fabricated vertical piping clamps of the MSS type and size indicated; comply with MSS SP-58 and the manufacturer's published product information. Where the MSS type or size is not indicated, provide proper selection as determined by the installer for installation requirements, and comply with MSS SP-69 and the manufacturer's published product information. Size clamps properly for piping, including insulation (if any).

B. Two Bolt Riser Clamp: MSS Type 8.

2.4 HANGER ROD ATTACHMENTS:

A. General: Except as otherwise indicated, provide factory fabricated hanger rod attachments of the MSS type and size indicated; comply with MSS SP-58 and the manufacturer's published product information. Where MSS type or size is not indicated, provide proper selection as determined by installer for installation requirements, and comply with MSS AP-69 and the manufacturer's published product information. Size attachments properly for piping, including insulation (if any).

B. Turnbuckles: MSS Type 13.

C. Weldless Eye Nut: MSS Type 17.

D. Malleable Eye Socket: MSS Type 16.

E. Clevises: MSS Type 14.

2.5 BUILDING ATTACHMENTS:

A. General: Except as otherwise indicated, provide factory fabricated building attachments of the MSS type and load rating indicated; comply with MSS SP-58 and the manufacturer's published product information. Where the MSS type or load rating is not indicated, provide proper selection determined by installer for installation requirements, and comply with MSS SP-69 and the manufacturer's published information. Size units properly for piping loading.

B. Concrete Inserts: MSS Type 18, steel.

C. Top Beam C-Clamps: MSS Type 19.

D. C-Clamps: MSS Type 23, steel

E. Top I-Beam Clamp: MSS Type 25.

F. Side Beam Clamp: MSS Type 20.

G. Beam Clamp/Eye Nut: MSS Type 28.

H. Wide Flange Beam Clamp/Eye Nut: MSS Type 29.

I. Beam Clamp/Extension Piece: MSS Type 30.

2.6 SADDLES AND SHIELDS:

A. General: Except as otherwise indicated, provide factory fabricated saddles and shields of the MSS type and size indicated; comply with MSS SP-58 and the manufacturer's published product information. Where the MSS type or size is not indicated, provide proper selection determined by installer for installation requirements, and comply with MSS SP-69 and the manufacturer's published product information. Size saddles and shields properly for insulation and vapor barriers (if any).

B. Protection Saddles: MSS Type 39.

C. Protection Shields: MSS Type 40.

D. High Density Insert Insulation Saddles: Provide products manufactured by Elcen Metal Products Company or Armacell International.

2.7 MISCELLANEOUS MATERIALS:

A. Metal Framing: Provide products complying with NEMA STD ML 1.

B. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.

PART 3 - EXECUTION

3.1 PREPARATION:

A. Proceed with the installation of hangers, supports and anchors only after the required building structural work has been completed in areas where work is to be installed. Correct inadequacies including (but not limited to) the proper placement of inserts, anchors and other building attachments.

3.2 INSTALLATION OF BUILDING ATTACHMENTS:

A. Install building attachments at the required locations within concrete or onto structural steel for proper piping support. Space attachments within the maximum piping span length indicated in MSS SP-69. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through the openings at the top of inserts. Prior to placing concrete, install nut in insert and screw threaded rod thru nut until rod is firmly against top of the insert body.

3.3 INSTALLATION OF HANGERS AND SUPPORTS:

A. General: Install hangers, supports, clamps and attachments to support piping properly from the building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with the maximum spacing complying with MSS SP-69. Where piping of various sizes is to be supported together with trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire of perforated metal to support piping, and do not support piping from other piping.

B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of the same type and style as installed for adjacent similar piping.

C. Prevent electrolysis in support of copper tubing by the use of hangers and supports which are copper plated, or by other recognized industry methods.

3.4 PROVISIONS FOR MOVEMENT:

A. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate the action of expansion joints, expansion loops, expansion bends and similar units.

B. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

1. Pipe Slopes: Install hangers and supports to provide the indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 are not exceeded.

C. Insulated Piping: Comply with the following installation requirements:

1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through the insulation; do not exceed pipe stresses allowed by ANSI B31.
2. Shields: Where low compressive strength insulation of vapor barriers are indicated on chilled water piping, install coated protective shields.
3. Saddles: Where insulation without vapor barrier is indicated (hot water piping), install protection saddles.

3.5 HYDRONIC PIPING

A. Conform to ASTM F708, MSS SP58, MSS SP69, MSS SP 89.

B. Hangers for Pipe Sizes 1/2 to 1-1/2”. Malleable iron adjustable swivel, split ring.

C. Hangers for Cold Pipe Sizes 2” and Over: Carbon steel, adjustable, clevis.

D. Hangers for Hot Pipe Sizes 2 to 4”. Carbon steel, adjustable, clevis.

E. Hangers for Hot Pipe Sizes 6” and Over: Adjustable steel yoke, cast iron roll, double hanger.

F. Multiple or Trapeze Hangers. Steel channels with welded spacers and hanger rods.

G. Multiple or Trapeze Hangers for Hot Pipe Sizes 6” and Over: Steel channels with welded spacers and hanger rods, cast iron roll.

H. Wall Support for Pipe Sizes to 3”. Cast iron hook.

I. Wall Support for Pipe Sizes 4” and Over: Welded steel bracket and wrought steel clamp.

J. Wall Support for Hot Pipe Sizes 6” and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.

K. Vertical Support: Steel riser clamp.

L. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

M. Floor Support for Hot Pipe Sizes to 4”: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

N. Floor Support for Hot Pipe Sizes 6” and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.

O. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

3.6 ADJUSTMENT OF HANGERS AND SUPPORTS:

A. Adjust hangers and supports and place grout as required under supports to bring piping to proper levels and elevations.

END OF SECTION 23.2117

SECTION 23.2123 - HYDRONIC PUMPS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. In-Line Pumps.

1.2 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

B. Section 23 0513 - Common Motor Requirements for HVAC Equipment.

C. Section 23 0716 - HVAC Equipment Insulation.

D. Section 23 2113 - Hydronic Piping.

E. Section 23 2114 - Hydronic Specialties.

1.3 REFERENCE STANDARDS

A. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2011.

B. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical Manufacturers Association; 2008 (Revised 2010) (ANSI/NEMA OS 1).

C. UL 778 - Standard for Motor-Operated Water Pumps; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Indicate hanging and support requirements and recommendations.

D. Millwright's Certificate: Certify that base mounted pumps have been aligned.

E. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Pump Seals: One set for each type and size of pump.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture, assembly, and field performance of pumps, with minimum three years of documented experience.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Armstrong Pumps Inc.

B. Bell & Gossett.

C. Taco.

D. Grundfos.

2.2 HVAC PUMPS - GENERAL

A. Provide pumps that operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

B. Minimum Quality Standard: UL 778.

C. Products Requiring Electrical Connection: Listed and classified by UL or testing agency acceptable to authority having jurisdiction as suitable for the purpose specified and indicated.

2.3 IN-LINE CIRCULATORS

A. Type: Horizontal shaft, single stage, direct connected, with resiliently mounted motor for in-line mounting, oil lubricated, for 125 psi maximum working pressure.

B. Casing: Cast iron, with flanged pump connections.

C. Impeller: Non-ferrous keyed to shaft.

D. Bearings: Oil-lubricated bronze sleeve.

E. Shaft: Alloy steel with bronze sleeve, integral thrust collar.

F. Seal: Mechanical seal, 225 degrees F maximum continuous operating temperature.

G. Drive: Flexible coupling.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide access space around pumps for service. Provide no less than minimum space recommended by manufacturer.

C. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For close coupled or base mounted pumps, provide supports under elbows on pump suction and discharge line sizes 4 inches and over. Refer to Section 23 0549.

D. Check, align, and certify alignment of base mounted pumps prior to start-up.

E. Lubricate pumps before start-up.

F. The contractor and manufacturer shall perform and document checks of the pumps including, but not limited to start-up, shaft alignment and adjustments, VFD operation, motor rotation, strainer cleaning, and vibration isolator adjustments.

END OF SECTION 23.2123

SECTION 23.2300 - REFRIGERANT PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping.

B. Refrigerant.

C. Moisture and liquid indicators.

D. Valves.

E. Strainers.

F. Filter-driers.

1.2 RELATED REQUIREMENTS

A. Section 23 0719 - HVAC Piping Insulation.

1.3 REFERENCE STANDARDS

A. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2013 (ANSI/ASHRAE Std 15).

B. ASHRAE Std 34 - Designation and Safety Classification of Refrigerants; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2013.

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2013.

D. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; The American Society of Mechanical Engineers; 2013.

E. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2011 (ANSI/ASME B31.9).

F. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2013.

G. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding; American Welding Society; 2011 and errata.

H. MSS SP-58 - Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2009.

1.4 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

B. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.

C. Liquid Indicators:

1. Use line size liquid indicators in main liquid line leaving condenser.

D. Filter-Driers:

1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.

C. Shop Drawings: Indicate schematic layout of system, including equipment, critical dimensions, and sizes.

D. Design Data: Submit design data indicating pipe sizing. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

E. Test Reports: Indicate results of leak test, acid test.

1.6 QUALITY ASSURANCE

A. Designer Qualifications: Design piping system under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in Pennsylvania.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum ten years of documented experience.

1.7 REGULATORY REQUIREMENTS

A. Conform to ASME B31.9 for installation of piping system.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.1 PIPING

A. Copper Tube: ASTM B280, H58 hard drawn.

1. Fittings: ASME B16.22 wrought copper.
2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy.

B. Pipe Supports and Anchors:

1. Provide hangers and supports that comply with MSS SP-58.

    a. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

2. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
4. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
5. Vertical Support: Steel riser clamp.
6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
7. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
8. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.2 REFRIGERANT

A. Refrigerant: R-454b or R-32 as defined in ASHRAE Std 34.

2.3 MOISTURE AND LIQUID INDICATORS

A. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

2.4 FILTER-DRIERS

A. Performance:

1. Pressure Drop: 2 psi, maximum, when operating at full connected evaporator capacity.
2. Design Working Pressure: 350 psi, minimum.

B. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.

C. Construction: UL listed.

1. Connections: As specified for applicable pipe type.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

E. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.5.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
7. Provide copper plated hangers and supports for copper piping.

F. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

G. Flood piping system with nitrogen when brazing.

H. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.

3.3 FIELD QUALITY CONTROL

A. Test refrigeration system in accordance with ASME B31.5.

B. Pressure test system with dry nitrogen to 200 psi. Perform final tests at 27 inches vacuum and 200 psi using halide torch. Test to no leakage.

3.4 CLOSEOUT

A. Provide documentation of the refrigerant charge quantity and pressure for each system.

END OF SECTION 23.2300

SECTION 23.2500 - HVAC WATER TREATMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Cleaning of piping systems.

B. Chemical feeder equipment.

C. Chemical treatment.

1.2 RELATED SECTIONS

A. Section 23 2113 - Hydronic Piping.

B. Section 23 2114 - Hydronic Specialties.

1.3 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.

C. Shop Drawings: Indicate system schematic, equipment locations, and controls schematics, electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Indicate placement of equipment in systems, piping configuration, and connection requirements.

E. Manufacturer's Field Reports: Indicate start-up of treatment systems when completed and operating properly. Indicate analysis of system water after cleaning and after treatment.

F. Certificate: Submit certificate of compliance from authority having jurisdiction indicating approval of chemicals and their proposed disposal.

G. Project Record Documents: Record actual locations of equipment and piping, including sampling points and location of chemical injectors.

H. Operation and Maintenance Data: Include data on chemical feed pumps, agitators, and other equipment including spare parts lists, procedures, and treatment programs. Include step by step instructions on test procedures including target concentrations.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Sufficient chemicals for treatment and testing during required maintenance period.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum five years of documented experience. Company shall have local representatives with water analysis laboratories and full time service personnel.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum 5 years of experience and approved by manufacturer.

1.5 REGULATORY REQUIREMENTS

A. Conform to applicable code for addition of non-potable chemicals to building mechanical systems and to public sewage systems.

B. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

1.6 MAINTENANCE SERVICE

A. Furnish service and maintenance of treatment systems for one year from Date of Substantial Completion. Include monthly service visits and all chemicals

B. Provide monthly technical service visits to perform field inspections and make water analysis on site. Detail findings in writing on proper practices, chemical treating requirements, and corrective actions needed. Submit two copies of field service report after each visit.

C. Provide laboratory and technical assistance services during this maintenance period.

D. Include two hour training course for operating personnel, instructing them on installation, care, maintenance, testing, and operation of water treatment systems. Arrange course at startup of systems.

E. Provide on-site inspections of equipment during scheduled or emergency shutdown to properly evaluate success of water treatment program, and make recommendations in writing based upon these inspections.

1.7 MAINTENANCE MATERIALS

A. See Section 01 6000 - Product Requirements, for additional provisions.

B. Supply sufficient chemicals for treatment and testing during warranty and service period.

C. Provide chemicals for additional 1-year from warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Proasys.

B. Chem-Aqua.

C. Water Treatment by Design.

2.2 MATERIALS

A. System Cleaner:

1. Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products; sodium tripoly phosphate and sodium molybdate.
2. Biocide chlorine release agents such as sodium hypochlorite or calcium hypochlorite.

B. Closed System Treatment (Water):

1. Sequestering agent to reduce deposits and adjust pH; polyphosphate.
2. Corrosion inhibitors; boron-nitrite, sodium nitrite and borax, sodium totyltriazole, low molecular weight polymers, phosphonates, sodium molybdate, or sulphites.
3. Conductivity enhancers; phosphates or phosphonates.
4. Biocide chlorine release agents such as sodium hypochlorite or calcium hypochlorite.

2.3 BY-PASS (POT) FILTER/FEEDER

A. 5.0 gallon with quick opening cap and 20 micron and 5 micron filter bags. Provide 20 of each type of filter bag for the Owner's use.

2.4 TEST EQUIPMENT

A. Provide white enamel test cabinet with local and fluorescent light, capable of accommodating 4 - 10 ml zeroing titrating burettes and associated reagents.

B. Provide the following test kits:

1. Alkalinity titration test kit.
2. Chloride titration test kit.
3. Sulphite titration test kit.
4. Total hardness titration test kit.
5. Low phosphate test kit.
6. Conductivity bridge, range 0 - 10,000 micro-ohms.
7. Creosol red pH slide complete with reagent.
8. Portable electronic conductivity meter.
9. High nitrite test kit.

PART 3 - EXECUTION

3.1 PREPARATION

A. Systems shall be operational, filled, started, and vented prior to cleaning. Use water meter to record capacity in each system.

B. Place terminal control valves in open position during cleaning.

3.2 CLEANING SEQUENCE

A. Concentration:

1. As recommended by CLEANER manufacturer.

B. Hot Water Heating Systems:

1. Add cleaner, apply heat while circulating, slowly raising temperature to 160 degrees F and maintain for 12 hours minimum.
2. Remove heat and circulate to 100 degrees F or less; drain systems as quickly as possible and refill with clean water.
3. Circulate for 6 hours at design temperatures, then drain.
4. Refill with clean water and repeat until system cleaner is removed.
5. Test water sample to verify cleaner is removed.

C. Use neutralizer agents on recommendation of system cleaner supplier and approval of Architect.

D. Flush open systems with clean water for one hour minimum. Drain completely and refill.

E. Remove, clean, and replace strainer screens.

F. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

G. System shall flushed, treated, and tested in accordance with the phasing. Multiple phased treatments will be required.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. After cleaning, fill each system completely with specified solution.

1. Hot Water System: 100% Water

3.4 CLOSED SYSTEM TREATMENT

A. Provide one bypass filter/feeder on each system. Install isolating and drain valves and necessary piping. Install around balancing valve downstream of circulating pumps unless indicated otherwise.

B. Introduce closed system treatment through bypass feeder when required or indicated by test.

C. Provide 3/4 inch water coupon rack around circulating pumps with space for 4 test specimens. Provide one for each bypass filter/feeder location.

3.5 CLOSEOUT ACTIVITIES

A. Training: Train Owner's personnel on operation and maintenance of chemical treatment system.

1. Provide minimum of two hours of instruction for two people.
2. Have operation and maintenance data prepared and available for review during training.
3. Conduct training using actual equipment after treated system has been put into full operation.

3.6 MAINTENANCE

A. Perform maintenance work using competent and qualified personnel under the supervision and in the direct employ of the equipment manufacturer or original installer.

B. Provide service and maintenance of treatment systems for one year from Date of Substantial Completion.

C. Provide monthly technical service visits to perform field inspections and make water analysis on site. Detail findings in writing on proper practices, chemical treating requirements, and corrective actions needed. Submit two copies of field service report after each visit.

D. Provide laboratory and technical assistance services during this maintenance period.

E. Provide on-site inspections of equipment during scheduled or emergency shutdown to properly evaluate success of water treatment program, and make recommendations in writing based upon these inspections.

END OF SECTION 23.2500

SECTION 23.3100 - HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal ductwork.

B. Casing and plenums.

1.2 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 09 9000 - Painting and Coating: Weld priming, weather resistant, paint or coating.

C. Section 23 0714 – HVAC Duct Insulation: External insulation and duct liner.

D. Section 23 3300 - Air Duct Accessories.

E. Section 23 3700 - Air Outlets and Inlets.

1.3 REFERENCE STANDARDS

A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals; 2009.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2008.

C. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and General Applications; 2012.

D. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip; 2012.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2011.

F. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2010.

G. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2010.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2012.

I. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2012.

J. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association; 2012.

K. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; National Fire Protection Association; 2011.

L. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2012, 2nd Edition.

M. SMACNA (DCS) - HVAC Duct Construction Standards; 2005.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for duct materials.

C. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.6 REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA 90A standards.

PART 2 PRODUCTS

2.1 DUCT ASSEMBLIES

A. All Ducts: Galvanized steel in concealed areas or galvannealed steel in exposed areas, unless otherwise indicated. All accessories shall be of the same material as the ductwork specified herein.

B. Low Pressure Supply: 2 inch w.g. pressure class, galvanized or galvannealed steel.

C. Medium and High Pressure Supply: 4 inch w.g. pressure class, galvanized or galvannealed steel.

D. Return and Relief: 2 inch w.g. pressure class, galvanized or galvannealed steel.

E. General Exhaust: 2 inch w.g. pressure class, galvanized or galvannealed steel.

F. Shower Room Exhaust: Aluminum up to the point where it connects to the Locker Room Exhaust System.

G. Outside Air Intake: 2 inch w.g. pressure class, galvanized steel.

H. Transfer Air and Sound Boots: 1 inch w.g. pressure class, galvanized steel.

I. Combustion Air: CPVC.

2.2 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. Galvannealed Steel for Ducts: Hot-dipped, zinc-iron coated, annealed steel sheet, ASTM A653-09.

C. Aluminum for Ducts: ASTM B209 (ASTM B209M); aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T651 or of equivalent strength.

D. Stainless Steel for Ducts: ASTM A 240/A 240M, Type 304.

E. PVC: ASTM D1785, Schedule 80.

1. Fittings: ASTM D2466 or D2467, PVC.
2. Joints: Solvent welded in accordance with ASTM D2855.
3. For underground applications, install per ASTM D2321.

F. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.

1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
2. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E84.

G. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

H. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:

1. Concrete Screw Type Anchors: Complying with ICC-ES AC193.

2.3 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards and as indicated.

B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. Provide turning vanes of perforated metal with closed cell foam insulation when acoustical lining is indicated.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA HVAC Duct Construction Standards.

F. Seal all joints and fittings

2.4 MANUFACTURED DUCTWORK AND FITTINGS

A. Double Wall Insulated Round Ducts: Round spiral lockseam duct with 18-gauge galvanized steel outer wall, perforated galvanized steel inner wall; fitting with solid inner wall.

1. Manufacture in accordance with SMACNA HVAC Duct Construction Standards.
2. Insulation:

    a. Thickness: 1.5 inch
    b. Material: Fiberglass.

B. Double Wall Rectangular Ducts: Rectangular double wall ducts shall have a solid 18-gauge galvanized steel outer shell and a perforated inner liner, separated with a 1.5” thick fiberglass insulating layer. Fittings shall have solid inner walls.

C. Flexible Ducts: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire.

1. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.
2. Maximum Velocity: 4000 fpm.
3. Temperature Range: -20 degrees F to 210 degrees F.
4. Minimum R-value: R-6

2.5 EXTERIOR DUCTWORK

A. Exterior ductwork shall be TDC flange type.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA HVAC Duct Construction Standards.

B. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

C. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

D. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

3.2 DUCT LEAKAGE TESTING

A. Perform duct leakage test in accordance with 230593 – HVAC Testing, Adjusting and Balancing. Perform all tests in accordance with SMACNA HVAC Air Duct Leakage Test Manual. Perform leakage test for 20% of medium and high-pressure duct systems and 10% of low-pressure duct systems. Leakage testing shall be conducted by the Contractor prior to system balancing.

3.3 CLEANING

A. The HVAC system shall be cleaned using source removal mechanical cleaning methods designed to extract contaminants from within the HVAC system and safely remove contaminants from the facility. It is the contractor's responsibility to select source removal methods that will render the HVAC system visibly clean and capable of passing cleaning verification. Means, methods and materials shall be as described in the NADCA General Specifications for the Cleaning of Commercial HVAC Systems manual, and other specified tests, in accordance with all general requirements. No cleaning method, or combination of methods, shall be used which could potentially damage components of the HVAC system or negatively alter the integrity of the system.

B. Exposed ductwork shall have its exterior cleaned (in accordance with the manufacturer's recommended methods) to the satisfaction of the Architect.

END OF SECTION 23.3100

SECTION 23.3300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Air turning devices/extractors.

B. Backdraft dampers.

C. Duct access doors.

D. Duct test holes.

E. Fire dampers.

F. Flexible duct connections.

G. Smoke dampers.

H. Volume control dampers.

1.2 RELATED SECTIONS

A. Section 23 3100 - HVAC Ducts and Casings.

B. Section 23 3600 - Air Terminal Units: Pressure regulating damper assemblies.

1.3 REFERENCES

A. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems; National Fire Protection Association; 2018.

B. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

C. UL 33 - Heat Responsive Links for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

D. UL 555 - Standard for Fire Dampers; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

E. UL 555S - Standard for Leakage Rated Dampers for Use in Smoke Control Systems; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide for shop fabricated assemblies including volume control dampers and duct access doors.

C. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers and duct access doors.

D. Manufacturer's Installation Instructions: Provide instructions for fire dampers and smoke dampers.

1.5 PROJECT RECORD DOCUMENTS

A. Record actual locations of access doors and test holes.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

1.8 EXTRA MATERIALS

A. Provide two of each size and type of fusible link.

PART 2 - PRODUCTS

2.1 AIR TURNING DEVICES/EXTRACTORS - AIRFOIL TYPE

A. Manufacturers:

1. Ruskin Company: www.ruskin.com.
2. Titus: www.titus-hvac.com.

B. Multi-blade device with radius blades attached to pivoting frame and bracket, steel construction, with worm drive mechanism with removable key operator.

2.2 BACKDRAFT DAMPERS

A. Manufacturers:

1. Louvers & Dampers, Inc: www.louvers-dampers.com.
2. Nailor Industries Inc: www.nailor.com.
3. Ruskin Company: www.ruskin.com.
4. Pottorff: https://www.pottorff.com.

B. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: galvanized steel, with center pivoted blades of maximum 6 inch width, with flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.3 DUCT ACCESS DOORS

A. Manufacturers:

1. Ruskin Company: www.ruskin.com.
2. Approved Equal.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

C. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch thick insulation with sheet metal cover.

1. Less Than 12 inches Square: Secure with sash locks.
2. Up to 18 inches Square: Provide two hinges and two sash locks.
3. Up to 24 x 48 inches: Three hinges and two compression latches with outside and inside handles.
4. Larger Sizes: Provide an additional hinge.

D. Access doors with sheet metal screw fasteners are not acceptable.

2.4 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.5 FIRE DAMPERS

A. Manufacturers:

1. Louvers & Dampers, Inc: www.louvers-dampers.com.
2. Nailor Industries Inc: www.nailor.com.
3. Ruskin Company: www.ruskin.com.
4. Pottorff: https://www.pottorff.com.

B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

C. Ceiling Dampers: Galvanized steel, 22 gage frame and 16 gage flap, two layers 0.125 inch ceramic fiber on top side and one layer on bottom side for round flaps, with locking clip.

D. Horizontal Dampers: Galvanized steel, 22 gage frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.

E. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream.

F. Multiple Blade Dampers: 16 gage galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

G. Fusible Links: UL 33, separate at 165 degrees F.

H. All dampers shall be dynamic type.

2.6 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

B. Flexible Duct Connections: Fabric crimped into metal edging strip.

1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.

a. Net Fabric Width: Approximately 2 inches wide.

2. Metal: 3 inches wide, 24 gage thick galvanized steel.

2.7 SMOKE DAMPERS

A. Manufacturers:

1. Louvers & Dampers, Inc: www.louvers-dampers.com.
2. Nailor Industries Inc: www.nailor.com.
3. Ruskin Company: www.ruskin.com.
4. Pottorff: https://www.pottorff.com.

B. Fabricate in accordance with NFPA 90A and UL 555S, and as indicated.

C. Dampers: UL Class 1 multiple blade type fire damper, normally closed automatically operated by electric actuator.

2.8 VOLUME CONTROL DAMPERS

A. Manufacturers:

1. Louvers & Dampers, Inc: www.louvers-dampers.com.
2. Nailor Industries Inc: www.nailor.com.
3. Ruskin Company: www.ruskin.com.
4. Pottorff: https://www.pottorff.com.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

C. Splitter Dampers:

1. Material: Same gage as duct to 24 inches size in either direction, and two gages heavier for sizes over 24 inches.
2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.
3. Operator: Minimum 1/4 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw.

D. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.

E. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

F. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

G. Quadrants:

1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
3. Where rod lengths exceed 30 inches provide regulator at both ends.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 3100 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated. Provide 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.

D. Provide duct test holes where indicated and required for testing and balancing purposes.

E. Provide fire dampers and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

F. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92A. Provide control wiring.

G. Demonstrate re-setting of fire dampers to Owner's representative.

H. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

I. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

J. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

K. Use splitter dampers only where indicated.

L. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

M. Provide turning vanes, Air Turning Devices, at all elbows greater than 45 degrees and all radiused elbows.

1. Provide Blades: 2" galvanized steel for up to and including 18" ducts.
2. Blades: 4 1/2" galvanized for ducts over 18"
3. Construction: Double wall blade.
4. Types: Gang operated blades with removable hex key.
5. Types: Gang operated blades with removable lever.
6. Types: Fixed blades for 90 degree elbows.

END OF SECTION 23.3300

SECTION 23.3416 – CENTRIFUGAL HVAC FANS

PART 1- GENERAL

1.1 SECTION INCLUDES

A. Centrifugal Roof Downblast Exhaust Fans.

B. Centrifugal Inline Fans.

C. Centrifugal Ceiling Exhaust and Cabinet Fans.

D. Ceiling Fans.

1.2 RELATED SECTIONS

A. Section 23 0513 - Common Motor Requirements for HVAC Equipment.

B. Section 23 3300 - Air Duct Accessories: Backdraft dampers.

1.3 REFERENCES

A. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2005.

B. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating; Air Movement and Control Association International, Inc.; 2007 (ANSI/AMCA 210, same as ANSI/ASHRAE 51).

C. AMCA (DIR) - [Directory of] Products Licensed Under AMCA International Certified Ratings Program; Air Movement and Control Association International, Inc.; http://www.amca.org/licenses/search.aspx.

D. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; Air Movement and Control Association International, Inc.; 2008.

E. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; Air Movement and Control Association International, Inc.; 2006.

F. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2009, Revision 1 - 2010.

G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2008.

H. UL 705 - Power Ventilators; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Indicate installation instructions.

D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Kitchen Range Hood Exhaust Fans: Comply with requirements of NFPA 96 and the International Mechanical Code.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Permanent ventilators may not be used for ventilation during construction.

1.7 EXTRA MATERIALS

A. Supply two sets of belts for each fan (if applicable).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Greenheck.

B. Loren Cook Company.

C. PennBarry.

2.2 POWER VENTILATORS - GENERAL

A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.

B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.

C. Sound Ratings: AMCA 301, tested to AMCA 300, and bearing AMCA Certified Sound Rating Seal.

D. Fabrication: Conform to AMCA 99.

E. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

F. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

G. Enclosed Safety Switches: Conform to NEMA 250.

H. Kitchen Range Hood Exhaust Fans: Comply with requirements of NFPA 96 and the International Mechanical Code.

2.3 CENTRIFUGAL ROOF DOWNBLAST EXHAUST FANS

A. General Description:

1. Fan shall be downblast type and shall be for roof mounted applications
2. Maximum continuous operating temperature shall be a minimum of 180 Fahrenheit (82.2 Celsius)
3. Each fan shall bear a permanently affixed manufacturer's engraved metal nameplate containing the model number and individual serial number.

B. Wheel:

1. Constructed of aluminum
2. Non-overloading, backward inclined centrifugal
3. Statically and dynamically balanced in accordance to AMCA Standard 204-05
4. The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency

C. Motors:

1. Electronically Commutated Motor

a. Motor enclosure: ODP
b. Motor to be a DC electronic commutation type motor (ECM) specifically designed for fan applications. AC induction type motors are not acceptable.

c. Motors shall be permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase
d. Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor
e. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal
f. Motor shall be a minimum of 85% efficient at all speeds

2. AC Induction Motor (Belt Driven Fans)

a. Motor enclosure: ODP
b. Motors are permanently lubricated, heavy duty ball bearing type to match the fan load and pre-wired to the specific voltage and phase.
c. Accessible for maintenance.

D. Shaft and Bearings (Belt Driven Fans):

1. Fan Shaft shall be ground and polished solid steel with an anti-corrosive coating
2. Permanently sealed bearings or pillow block ball bearings
3. Bearing shall be selected for a minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed
4. Bearings are 100 percent factory tested
5. Fan Shaft first critical speed is at least 25 percent over maximum operating speed

E. Housing:

1. Motor cover, shroud, curb cap, and lower windband shall be constructed of heavy gauge aluminum
2. Shroud shall have an integral rolled bead for extra strength
3. Shroud shall be drawn from a disc and direct air downward
4. Lower windband shall have a formed edge for added strength
5. Motor cover shall be drawn from a disc
6. All housing components shall have final thicknesses equal to or greater then preformed thickness
7. Curb cap shall have pre-punched mounting holes to ensure correct attachment
8. Rigid internal support structure
9. Leak proof

F. Housing Supports and Drive Frame:

1. Drive frame assemblies shall be constructed of heavy gauge steel and mounted on vibration isolators

G. Vibration Isolation:

1. Rubber isolators
2. Sized to match the weight of each fan

H. Disconnect Switches:

1. NEMA rated: NEMA 1: indoor application no water. Factory standard.
2. Positive electrical shut-off
3. Wired from fan motor to junction box installed within motor compartment

I. Drive Assembly (Belt Driven Fans):

1. Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower
2. Belt: Static free and oil resistant
3. Fully machined cast iron type, keyed and securely attached to the wheel and motor shafts
4. Motor pulleys are adjustable for final system balancing
5. Readily accessible for maintenance

J. Options/Accessories:

1. Birdscreen:

   a. Material Type: Galvanized
   b. Protects fan discharge

2. Roof Curbs:

   a. Welded, straight sided curb with 2 inches of flashing flange and wood nailer
   b. Material: Galvanized
   c. Height: 18”
   d. Insulation thickness: 1.5 inches

3. Dampers:

   a. Gravity backdraft damper
   b. Prevents outside air from entering back into the building when fan is off
   c. Balanced for minimal resistance to flow
   d. Galvanized frames with prepunched mounting holes

4. Variable Frequency Drive (Belt Driven Fans):

   a. Factory programed, mounted and wired
   b. Input speed control: On-Board Dial
   c. 24VDC damper power output
   d. Motor: (VFD Rated) compatible with induction and permanent magnet motors
   e. Parameters of acquainted motor shall be set to include voltage, speed, FLA, acceleration/deceleration time, and minimum and maximum motor frequency
   f. R3 Filtering for harmonic mitigation
   g. UL Recognized for 3 phase input at 380V-480V
   h. NEMA 4X Enclosure
   i. LED indication for Power, Run, and Fault

2.4 CENTRIFUGAL INLINE FANS

A. General Description:

1. Base fan performance at standard conditions (density 0.075 Lb/ft3)
2. Fan operating temperature shall be a minimum of 130 Fahrenheit (54.4 Celsius)
3. Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number

B. Wheel:

1. Non-overloading, backward inclined centrifugal wheel
2. Constructed of aluminum
3. Statically and dynamically balanced in accordance to AMCA Standard 204-05
4. The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency
5. Single thickness blades are securely riveted or welded to a heavy gauge back plate and wheel cone.

C. Motors:

1. Motor enclosures: Open type
2. Motor to be a DC electronic commutation type motor (ECM) specifically designed for fan applications. AC induction type motors are not acceptable.
3. Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase.
4. Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor.
5. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal.
6. Motor shall be a minimum of 85% efficient at all speeds.

D. Housing:

1. Constructed of heavy gauge galvanized steel
2. Housing and bearing supports shall be constructed of heavy gauge bolted and welded steel construction to prevent vibration and to rigidly support the shaft and bearing assembly.

E. Spring Loaded Aluminum Backdraft Damper:

1. Prevents air from entering back into the building when fan is off
2. Eliminates rattling or unwanted backdrafts

F. Accessories:

1. Provide unit mounted disconnect switch.

2.5 CENTRIFUGAL CEILING EXHAUST AND CABINET FANS

A. General Description:

1. Fan shall be for ceiling mounted applications
2. Fan maximum operating temperature shall be a minimum of 130 Fahrenheit (54.4 Celsius)
3. UL/cUL listed 507 - Electric Fans
4. Each fan shall bear a permanently affixed manufacture's nameplate containing the model number and individual serial number

B. Wheel:

1. Forward curved centrifugal wheel
2. Constructed of galvanized steel
3. Statically and dynamically balanced in accordance to AMCA Standard 204-05

C. Motors:

1. Motor enclosures shall be open driproof (ODP), opening in the frame body and or end brackets
2. Motors are permanently lubricated sleeve bearing type to match with the fan load and furnished at the specific voltage and phase
3. Motor shall be mounted on vibration isolators and be accessible for maintenance
4. Thermal overload protection

D. Housing:

1. Constructed of heavy gauge galvanized steel
2. Interior shall be lined with 0.5 inches of acoustical insulation

E. Spring Loaded Aluminum Backdraft Damper:

1. Prevents air from entering back into the building when fan is off
2. Eliminates rattling or unwanted backdrafts

F. Grille:

1. Types: Aluminum

G. Accessories:

1. Provide unit mounted disconnect switch.

2.6 CEILING FANS

A. Manufacturer:

1. Big Ass Fans; Powerfoil 5.

2. Pre-approved equal.

B. Complete Unit

1. Regulatory Requirements:

a. The entire fan assembly, as a system, shall be Nationally Recognized Testing Laboratory (NRTL)-certified and built pursuant to the construction guidelines set forth by UL standard 507 and CSA standards 22.2 No. 60335-1 and 22.2 No. 60335-2-80.
b. Ceiling fans greater than 7 ft (2.14 m) in diameter shall be tested and have performance data determined in accordance with 10 CFR Appendix U to Subpart B of Part 430 - Uniform Test Method for Measuring the Energy Consumption of Ceiling Fans and shall be listed in the US DOE Compliance Certification Database (CCD).
c. Ceiling fans greater than 7 ft (2.14 m) in diameter shall exceed the US DOE minimum-efficiency requirement of CFEI 1.00 at high speed and CFEI 1.31 at 40 percent speed or the nearest speed that is not less than 40 percent speed.
d. HVLS fans shall be listed in the California Energy Commission's Modernized Appliance Efficiency Database System of Appliance Models (MAEDbS), as required by Section 1606 of California Title 20.
e. Fans shall comply with all applicable requirements of Section 403 of the International Energy Conservation Code, Chapter 9 of the International Mechanical Code, and Chapter 6 of ANSI/ASHRAE/IES Standard 90.1.
f. The digital wall controller shall be compliant with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) The device may not cause harmful interference, and (2) The device shall accept any interference received, including interference that may cause undesirable operation.

2. Sustainability Characteristics:

a. The fan shall be designed to move an effective amount of air for cooling and destratification in industrial applications over an extended life. The fan components shall be designed specifically for high volume, low speed fans to ensure lower operational noise. Sound levels from the fan operating at maximum speed measured in a laboratory setting shall not exceed 55 dBA. Actual results of sound measurements in the field may vary due to sound reflective surfaces and environmental conditions.
b. The Wired Standard Control shall be designed to control Big Ass Fans from a secure, centralized location, and shall be designed specifically for high volume, low speed Big Ass Fans to ensure maximum control.
c. The optional BAFCon controller shall be designed to control Big Ass Fans and lighting systems from a secure, centralized location. The system shall be designed specifically for high volume, low speed Big Ass Fans to ensure maximum control. The system shall include optional SmartSense functionality to maximize energy savings. SmartSense shall provide the capability to automatically control the speed of Big Ass Fans using information from user-determined settings and built-in temperature and humidity sensors.

3. Good workmanship shall be evident in all aspects of construction. Field balancing of the airfoils shall not be necessary.
4. High volume, low speed (HVLS) fans shall be licensed to bear the AMCA Certified Rating Seal for Circulating Fan Performance to ensure performance as cataloged in the field. Unlicensed HVLS fans shall not be accepted.

C. Onboard Fan Control

1. The onboard fan controller shall be constructed using a variable frequency drive (VFD) that is pre-wired to the motor and factory-programmed to minimize the starting and braking torques for smooth and efficient operation. The onboard controller shall be pre-wired to the motor using a short run of flexible conduit with a dedicated ground conductor to minimize electromagnetic interference (EMI) and radio frequency interference (RFI). A 15-ft (4.6-m) incoming power cord shall be pre-wired to the controller.
2. For fans with single-phase input, conversion to three-phase output takes place at the VFD.
3. The VFD shall have a minimum rating of IP56.

D. Airfoil System

1. The fan shall be equipped with five (5) Powerfoil airfoils of precision extruded aluminum alloy. The airfoils shall be connected by means of two (2) high strength locking bolts per airfoil. The airfoils shall be connected to the hub and interlocked with zinc plated steel retainers. All airfoil hardware shall be SAE Grade 8 or equivalent.
2. The fan shall be equipped with five (5) Powerfoil winglets on the ends of the airfoils. The winglets shall be molded of a polypropylene blend. The standard color of the winglet shall be “BAF Yellow.”
3. Airfoil Restraint System

    a. All 20- to 24-ft (6- to 7.3-m) diameter fans shall be equipped with a patented airfoil restraint system to provide redundant safety between the ends of the airfoils and the fan hub. The airfoil restraint system shall be available as an option on smaller diameter fans.
    b. The airfoil restraint system shall be comprised of durable, lightweight nylon safety straps that shall extend from the winglets through the airfoils and secure to the fan hub with 12-gauge stamped steel safety clips.
    c. The straps shall be made of 1 in. (24 mm) wide heavy-duty nylon webbing rated for 825 lb (374 kg). The loops at the ends of the straps shall be secured in a double-stitch pattern for reinforced durability.
    d. The straps shall be precisely matched to each fan’s diameter, eliminating the need for a tensioning mechanism and reducing the opportunity for noise.
    e. The straps shall run along the inside of the airfoils for an uninterrupted look.
    f. Safety clips shall secure to each winglet to comprise the outer anchor points and provide tension, while clips on the opposite end shall secure to threaded inserts incorporated in the fan hub.

E. Motor

1. The fan motor shall be an AC induction type inverter rated at 1725 RPM, 200–240/400–480 VAC, 50/60 Hz, three-phase.
2. The motor shall be totally enclosed, fan cooled (TEFC) with an IP56 rating. A B5 standard frame shall be provided for ease of service. The motor shall be manufactured with a double baked Class F insulation and be capable of continuous operation in 5°F to 104°F (-15°C to 40°C) ambient conditions.

F. Gearbox

1. The gearbox shall be a helical gear reducer, precision finished from hardened steel for low noise and long service life with double lip seals to retain oil and prevent contamination. The gearbox shall be lubricated for life. The gear reducer shall have a standard backlash of less than 25 arc minutes and be equipped with a 17-4 stainless steel shaft of 1-1/4" (3.2 cm) diameter.

G. Motor Frame

1. The motor frame and mount shall be constructed of steel and powder coated for corrosion resistance and appearance.

H. Mounting System

1. The fan mounting system shall be designed for quick and secure installation on a variety of structural supports. The design of the upper mount shall provide two axes of rotation. This design shall allow for adjustments to be made after the mount is installed to the mounting structure to ensure the fan will hang level from the structure.
2. The upper mount shall be of ASTM A-36 steel, at least 3/16" thick, and powder coated for appearance and corrosion resistance. No mounting hardware or parts substitutions, including cast aluminum, are acceptable.
3. All mounting hardware shall be SAE Grade 8 or equivalent.

I. Hub

1. The fan hub shall be 19" (48 cm) in diameter and shall be made of precision cut aluminum for high strength and light weight. The hub shall consist of two (2) aluminum plates, five (5) aluminum spars, and one (1) aluminum spacer fastened with a pin and collar rivet system. The overall design shall provide a flexible assembly such that force loads experienced by the hub assembly shall be distributed over a large area to reduce the fatigue experienced at the attachment point for the fan blade.
2. The hub shall be secured to the output shaft of the gearbox by means of a steel coupling interface. The hub shall incorporate five (5) safety retaining clips made of 1/4" (0.6 cm) thick steel that shall restrain the hub/airfoil assembly.

J. Safety Cables

1. The fan shall be equipped with an upper safety cable that provides an additional means of securing the fan assembly to the building structure. The upper safety cable shall have a diameter of Ø1/4" (0.6 cm).
2. The fan shall be equipped with two lower safety cables pre-attached to the fan hub that shall provide an additional means of securing the fan to the extension tube. The lower safety cables shall have a diameter of 1/4" (0.6 cm).
3. The safety cables shall be fabricated out of 7 x 19 galvanized steel cable. The end loops shall be secured with swaged Nicopress® sleeves, pre-loaded and tested to 3,200 lbf (13,345 N).
4. Field construction of safety cables is not permitted.

J. BAFCon Controller

1. The fan shall be provided with a BAFCon controller.
2. The digital controller user interface shall be a wall-mounted touchscreen with a 5-inch (127-mm) display and an 800 (RGB) x 480 pixel resolution.
3. The digital controller shall be mounted to a standard rectangular or square outlet box.
4. A 150-ft (45.7-m) CAT5 cable shall be provided for connecting the digital controller to the fan's VFD, allowing for seamless communication between BAFCon and the VFD. The cable shall provide power to the digital controller.
5. The digital controller shall not require a 120 V power supply at the controller mounting location.
6. The digital controller mounting location shall meet the requirements of OSHA standard 29 CFR 1910.303(g) for accessibility minimum clearances.
7. The digital controller shall support up to 24 fans controlled as a group or individually.
8. The digital controller shall provide fan start/stop, speed, and direction control functions.
9. The digital controller shall provide diagnostic and fault history information for each connected fan as well as the ability to configure fan parameters with the assistance of Big Ass Fans Customer Service.
10. The digital controller shall include optional SmartSense functionality to maximize energy savings. SmartSense shall provide the capability to automatically control the speed of Big Ass Fans using information from user-determined settings and built-in temperature and humidity sensors.
11. The digital controller shall include a scheduling feature that shall provide the ability to create up to four fan schedules for turning fans on/off and turning Auto mode on/off. The scheduling feature shall require the date and time to be set on the controller.
12. The digital controller interface shall be able to be secured with user and admin passcodes to prevent unauthorized access to fan controls and settings.
13. The digital controller shall be BACnet-compatible.
14. BAFCon Multi-Fan Accessory Kit (Optional)

    a. If multiple fans will be installed with the BAFCon controller, the BAFCon Multi-Fan Accessory Kit shall be available.

L. Fire Control Panel Integration

1. Includes a 10–30 VDC pilot relay for seamless fire control panel integration. The pilot relay can be wired Normally Open or Normally Closed in the field.

M. Guy Wires

1. Included for installations with extension tubes 4 ft (1.2 m) or longer to limit the potential for lateral movement.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure roof exhausters with cadmium plated steel lag screws to roof curb.

C. Extend ducts to roof exhausters into roof curb. Counter flash duct to roof opening.

D. Provide sheaves required for final air balance.

E. Install backdraft dampers on inlet to roof and wall exhausters, except kitchen hood fans.

F. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

END OF SECTION 23.3416

SECTION 23.3516 – VEHICLE EXHAUST EXTRACTION SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Magnetic type source capture exhaust removal system.

1.2 RELATED REQUIREMENTS

A. NIOSH Pocket Guide to Chemical Hazards

B. Underwriters Laboratory (UL)

C. National Fire Protection Agency (NFPA)

1. National Electric Code (NEC)
2. NFPA 1500

D. Air Movement (AMCA)

E. International Mechanical Code (IMC)

F. Uniform Mechanical Code (UMC)

G. American National Standards Institute (ANSI)

H. American Society of Mechanical Engineers (ASME)

1.2 MANUFACTURER QUALIFICATIONS

A. The manufacturer must be ISO 9001:2000, UL and CUL Certified and have their Exhaust Blowers certified by the Air Movement and Control Association (AMCA) to ensure quality, consistency and reliability of products. Certification documents shall be provided and attached to the bid proposal. All workmanship, manufacturing procedures, airflow design and materials shall be performance guaranteed.

B. The manufacturer has established reputation in the business of manufacturing Vehicle Exhaust Extraction Systems for a minimum of no less than Thirty (30) years. System has life of service of no less than Thirty (30) years to establish proof of quality, longevity, and service.

C. Equipment and materials provided for the system installation(s) shall be manufactured and provided by the supplier of primary exhaust removal system (Equipment Manufacturer) and be a standard product of manufacturer currently engaged in the manufacture of Vehicle Exhaust Extraction Systems. Where the requirement calls for a packaged exhaust system to be provided, all items shall be the product of the manufacturer. The product offering is to be a product that has been offered before a minimum period of Thirty (30) years.

1.4 TRAINING

A. Training is to be provided by manufacturer certified installer to the Fire Department Staff for the use and operation of the vehicle exhaust system.

B. An operation/training manual will be supplied as a permanent training aid.

1.5 WARRANTY

A. Vehicle Exhaust System Manufacturer's parts for a minimum of Five (5) Years on all parts and Ten (10) years on all aluminum extrusions (physical rails, aluminum tubing, etc.)

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Plymovent.

B. Nederman.

C. Ventaire.

2.2 TRACK EQUIPMENT TYPE

A. Shall be delivered and installed as a magnetic Sliding Balancer Track system. This type of system is designed for vehicles with under carriage exhaust tailpipe configurations. It will handle one apparatus per bay with back-in configurations allowing the operator to attach the system at the vehicle entrance and reach its designated rest position.

B. The operating logic of this system shall complete the following cycle. Upon the vehicles return to the apparatus floor of the station, a 5" dia. exhaust ventilation hose equipped with a magnetic nozzle shall be attached to the vehicle tailpipe at the door opening. The design shall ensure virtually 100% source capture of the exhaust fumes at the tailpipe. Once the system has been secured to the vehicles tailpipe, the exhaust fan shall automatically and instantaneously be energized by the output pressure of exhaust from any motor vehicle to assure total collection of exhaust gases. The vehicle can now back into its designated position and the hose will follow.

C. Upon emergency dispatch of the vehicle, the output pressure generated by any internal combustion engine shall again automatically energize the exhaust fan. As the vehicle leaves the apparatus floor, the flexible hose shall travel along the track and trolley system with the vehicle as it exits the station. The nozzle shall disconnect automatically and smoothly from the vehicle at a preset distance from the exiting door. The exhaust fan will continue to run to evacuate the exhaust from the duct system and then shut down automatically.

D. SAFETY FEATURE

1. Due to the harmful effects of diesel exhaust, the system must be designed and capable of capturing virtually 100% of the exhaust gas and particulate at the tailpipe. The system shall not detach itself from the apparatus during power failure. Connection of the system shall be achieved without bending over in front of the tailpipe.

E. SLIDING BALANCER TRACK

1. The track shall be 19 feet continuous in length without splices, have a maximum weight of 35 pounds and have a load capacity rating of 5800 pounds. Construction profile shall be of a boxloc type with cross sectional structural support for torsion reinforcement.

F. TRACK MOUNTING COMPARTMENT

1. Shall accept 8” length slider bars, which are utilized to secure vertical support legs to the boxloc track and distribute the load across the top of the track. This method of attachment ensures an enduring fastening system in the event the track comes in contact with a moving vehicle or encounters an unforeseeable force.

G. MOUNTING SUPPORT LEGS

1. Support legs shall be provided for every 10’ of track length. Supports shall be constructed of 2”x2” x 1/8” wall thickness tube aluminum alloy to provide strength and keep total system weight to a minimum. Leg supports shall be a one piece construction. All leg supports shall have side bracing constructed from tubular zinc plated steel to provide stabilization of track system. Angle shall be completely adjustable to the leg support and mounted perpendicular to direction of track. Typical support angle shall be 45 degrees from center line of support.

H. TRACK TROLLEY

I. Fixed to trolley with a use of solid steel pins shall be four load carrying bearings which are sealed and permanently lubricated. Load carrying bearings shall travel internally in track trolley compartment. Two Accu track bearings shall be provided on bottom side of external portion of track to eliminate or greatly reduce wobble of trolley to provide smooth travel along full length of track. Release plate shall be attached to energize uncoupling release valve when trolley balancer assembly passes under uncoupling valve.

I. TRACK SPLICE ASSEMBLY

1. In the event it is required to extend the length of track greater than its 19 foot continuous length, a track splice shall be provided. Track splice shall be manufactured of zinc plated steel in two parts as a clamp. This clamp shall accurately secure both tracks in a fashion which shall eliminate any possibility of problem passage through this splice. Connecting length of splice shall be a minimum of 15 ¾" long and fabricated of 14 gauge material. Four ¼" bolts with lock nuts shall pass directly through internal partition of boxloc track.

J. TRACK JOINER PLATE

1. In the event that it is necessary to join two tracks in a parallel configuration, a joiner plate shall be provided for proper support to both tracks and secure mounting to support leg assembly.

K. PRIMARY ENDSTOPS

1. Shall be installed inside the end of the track and fabricated of zinc plated steel in U-shape form with rubber endstop on the impact end of the endstop. It is attached by using a ¼" molded locking bolt. Endstop shall be secured to track with no less than (2) ¼" bolts and locking nuts located on the underside of the track.

L. DUCT/HOSE RISER BRACKET

1. The bracket, manufactured for the purpose of transitioning from flexible duct to solid spiral duct, shall be fabricated as a one piece welded assembly. Riser bracket shall mount directly to the track to provide stabilization to duct system and provide support to the flexible hose. Connecting the duct system directly to the traveling hose assembly is unacceptable.

M. BALANCER BLOCK

1. A balancer shall be used to keep the hose off the floor and away from the vehicle. It shall be a self adjusting, weight balancer with a lifting capacity of no less than 37 Lbs. and provide a constant lifting force without locking in an extended position. Balancer shall have a minimum diameter stainless steel cable of .080 for the purpose of retracting the hose away from the vehicle upon release. A steel cable shall be used for strength and durability and shall not be substituted.

N. UPPER HOSE ASSEMBLY

1. The upper hose shall be 5" in diameter manufactured for the sole purpose of venting high temperature exhaust gases, which are produced by internal combustion engines. Due to the increased temperatures associated with vehicle regeneration filter cleaning the flexible hose shall be rated for 900 degrees (F) continuous, 1,050 degrees (F) intermittent temperatures. The outside of the exhaust hose shall have a protective lamination the entire length of the hose to protect fire apparatus in the event vehicle and hose come in contact with each other.

O. LOWER HOSE ASSEMBLY

1. Shall be a rigid 2 foot long section of hose identical in characteristics to the upper hose assembly. Lower hose shall support connection nozzle and reducing elbow in a rigid fashion as to allow for operator to place hose collection device onto tailpipe without bending over. Lower hose is the only section of hose which shall release in the event of safety disconnect.

P, SAFETY HANDLE DISCONNECT COUPLING

1. Incorporated in the design of the system shall be a safety breakaway device enabling a physical disconnect between the exhaust system and the vehicle in the event of system malfunction or human error. The devise shall incorporate a handle for attaching the system to the vehicle without bending over. The coupling will enable the lower two foot hose assembly to freely rotate 360 degrees. The device shall utilize a quick connect fitting so the lower hose can be snapped back into place without the use of any tools. The quick connect also allows the lower hose to be manually disconnected and relocated to any other system should the vehicle be relocated. This feature provides safety to personnel, protects the apparatus and the exhaust system from damage, and provides user friendliness. This device shall be reusable and have an adjustable release tension of 20 – 206 Lbs. with a factory preset at 130 Lbs. Since this item is a point of safety for both personnel and the system itself, no exception may be taken to this feature.

Q. HOSE SUSPENSION SADDLE

1. The hose saddle shall be fabricated of steel with a heat resistant protective paint. The saddle shall support the hose and serve as the stress point during the system release. The design of saddle shall join two sections of hose together at its midpoint intersection and provide a smooth 93 degree transition.

R. MAGNETIC NOZZLE &TRANSITION ELBOW

1. The nozzle attachment shall be designed to mate up with the vehicle tailpipe in such a manor to prevent the operator from having to bend over to attach the nozzle. The connection shall be kept simple so the operator can attach the nozzle at any angle without having to align components to the vehicle. Simplicity of nozzle attachment will be determined by the fire department.
2. The nozzle will allow a sealed connection to the end of the tailpipe which is to be outfitted with a conical male adaptor designed for mating up with the nozzle. It is preferred the nozzle shall be fabricated from zinc plated steel and stainless steel for strength and malleability superior properties over aluminum. The nozzle shall also have the ability to add or subtract magnets from the nozzle thereby providing an adjustment capability for magnetic hold strength to the tailpipe conical adaptor. The manufacture shall offer the nozzle and tailpipe adaptor in 3”, 3.5”, 4”, 5”, 6” & 7” diameters to accommodate all tailpipe diameters and configurations.

3. To ensure there is no leakage of exhaust, the magnetic connection shall be accomplished in such a manner that there is no gap between the vehicle tailpipe termination point and the nozzle connection to the tailpipe The earth magnets shall be adjustable and easily removable for replacement. They shall be positioned to hold the nozzle connection to the tailpipe while the vehicle is entering and exiting the station without releasing. The nozzle shall incorporate a debris screen to prevent foreign objects from entering the system and a 67 degree transition to direct the exhaust gasses up the hose. The exterior of the nozzle shall be chrome plate for corrosion resistance and aesthetics.

2.3 VEHICLE TAILPIPE CONFIGURATION

A. Tailpipe conical adaptors shall be provided for all apparatus'. The adaptor shall be the same size as the vehicle tailpipe and allow the induction of ambient air into the nozzle. The tailpipe adaptor shall be constructed of corrosion resistant zinc plated steel with completely smooth edges to reduce grime accumulation. The fire department will be responsible for modify the exhaust pipes per the manufactures suggested recommendation so long as they comply with NFPA standards. The installing contractor shall coordinate with the department for having the tailpipes modified. All tailpipes will be modified by the owner.

2.4 EXHAUST FAN TYPE

A. The blower unit shall be a AMCA type B, direct drive spark resistant blower capable of delivering 500 CFM per vehicle. Exhaust fan offered shall be tested in accordance to AMCA standard # 210 in an AMCA approved test facility.

B. EXHAUST BLOWER

1. Shall provide a minimum of 500 CFM per vehicle at the properly calculated pressure loss of the system design.

C. FAN HOUSING & IMPELLER

1. The exhaust fan shall be AMCA type B direct drive spark resistant. The housing shall be a one piece construction fabricated from galvanized steel with epoxy powder coated paint inside and out. The design shall allow the user to remove the fan motor and impellor without removing the inlet or outlet duct connections. Impeller shall be fabricated from Aluminum and be designed as a Radial blade backward incline type wheel.

D. FAN MOTOR

1. Shall be UL listed and manufactured by a readily available nationally recognized motor manufacturer and meet EPAC standards.

E. MOTOR TYPE

1. Shall be supplied as a totally enclosed fan cooled or ventilated type with a readily available NEMA frame from 5 6 - 145 T.

F. MOTOR BEARINGS

1. Shall be provided as totally enclosed self lubricated type.

G. VIBRATION ISOLATING

1. Fan shall be manufactured as a complete assembly to assure the least possible vibration or movement. Fan wheel shall be both statically and dynamically balanced.

2.6 DUCTWORK

A. SMACNA class I conveying and must meet or exceed criteria for construction and performance as outlined in Round Industrial Duct Construction Standards for the designed operating pressure.

B. CERTIFICATION/APPROVALS

1. Construction, performance and installation must be performed to meet or exceed the International Mechanical Code as well as the uniform fire code. In turn the bidder must certify that they will adhere to all applicable city, state and federal codes.

C. MATERIALS OF CONSTRUCTION

1. Materials of construction unless otherwise specified for all duct and fittings shall be in minimum G-30 galvanized sheet metal in accordance with ASTM-A525 and A527.

D. DUCT SIZE

1. All duct subject to positive or negative pressure shall be of round spiral pipe construction, with the range of available sizes not to exceed 14 inches in diameter.

E. DUCT GAUGE

1. Duct gauge shall depend on diameter and a minimum operating pressure. Acceptable gauge and reinforcement requirements shall be in accordance with SMACNA guidelines. Bidder shall document their designed operating pressure on their design submission.

F. DUCT LENGTH

1. Duct shall be provided in 10’ continuous lengths wherever possible. Except when interrupted by fittings, round spiral duct section shall not be less than 10 feet long.

G. EXHAUST FITTINGS

1. All exhaust fittings shall be round and have a wall thickness 2 gauges (one even gauge number) heavier than the lightest allowable gauge of the downstream section of duct to which they are connected. Branch entrances shall be factory fabricated fittings or factory fabricated duct /tap assemblies. Fittings shall be constructed so that air streams converge at angles of 45°.

H. STANDARD WELDED SEAMS

1. Standard seam joints shall be continuous welded on all fittings. All welded joints shall be coated with a protective paint, inside and out to prevent damage to galvanized surface.

I. TURNING ELBOWS

1. Shall be die stamped and used for all diameters and pressures.

J. TAPERED BODY FITTINGS

1. Shall be used wherever particular fallout is anticipated, and where air flow is introduced to the transport duct manifold.

K. EXHAUST JOINT CONSTRUCTION

1. All joint connections which are not continuous welded shall be supplied with a transition coupling from the downstream end only. Coupling shall be fully welded and shall provide a fitting size projection to fit inside a downstream fitting or another duct section. Couplings shall have a two inch minimum insertion length and shall be 2 gauge numbers (one even gauge number) heavier than the duct to which they are connected. This along with a 600 high temperature silicon seal will constitute the primary mechanical seal.

L. DUCT CONVEYING VELOCITY

1. Shall be a minimum of 2000 - 3000 feet / minute transport velocity per UMC code. No exceptions.

M. EXHAUST RAIN CAP

1. Shall be manufactured in accordance with EPA standard for free draft rain cap requirements. Included as an intricate part of this rain cap shall be a back draft damper to provide protection from rain and other inclement weather.

N. EXHAUST DUCT PENETRATION

1. In all cases when making a wall penetration it should be clearly indicated in the bid drawing and be accomplished via use of a professional core drilling machine if possible. The core drilling shall be properly sized to reduce the diameter to the smallest possible size.

2.7 CONTROLLER TYPE

A. Shall be manufactured and delivered as an Operating System Three series controller, as manufactured by Plymovent Corporation or as an equal to the specifications to follow.

B. CONTROLLER LOGIC

1. Shall be designed to sense the output pressure which is normally generated by any internal combustion engine designed to propel any motor vehicle. The operating logic shall be designed to complete this cycle, at any point in time, when a collection device is connected to a motor vehicle's exhaust tail pipe and at which time the vehicle is manually or automatically energized by the operator. This controller shall in turn automatically sense the engine's output pressure and in turn energize the electrical contactors which will provide proper full load amperage to the exhaust system motor. The controller through the use of a three minute adjustable timer shall keep the contactors energized for the three minute minimum fixed time

2.8 ELECTRICAL PROTECTION

A. To protect the apparatus electrical system from any possible damage, the system **shall not** incorporate any design that requires the apparatus to be utilized as an electrical ground.

B. CERTIFICATION/APPROVALS

1. Electrical controller offered to the department shall be approved by Underwriters Laboratories (UL) as a complete electrical system for enclosed industrial control panels.

C. ELECTRICAL ENCLOSURE

1. Shall be NEMA 12 rated and UL listed as Type 12.

D. ENCLOSURE KEYLOCK

1. Shall be provided and mounted in electrical enclosure to restrict access to internal components of controller by only authorized entry.

E. ELECTRICAL CONTACTORS

1. Shall be Allen Bradley industrial electrical contactors provided with the appropriate adjustable overload relays to meet the proper full load amperage of motor it is designed to control. Contactor shall conform to the following standards: BS-5424, VDE0660, and be approved by UL Certification as an approved component.

F. CONTROL TRANSFORMER

1. To be UL listed industrial control circuit transformer with primary and secondary fuse blocks. Transformer shall be provided with multitap primary 208V through 480V, AC, and 24V through 120V secondary.

G. ELECTRICAL TIMER

1. Shall be solid state, 3 minute adjustable timer. Operating logic shall complete this cycle; Input voltage is applied to the timer at all times. Upon closure of a normally open isolated start switch, the load energizes and remains energized as long as the switch is closed. When the start switch opens, the timing cycle starts. At the end of the present time delay, the load de-energizes and the timer is ready for a new timing cycle. Timer shall be UL Recognized component under file number E65038.

H. ENGINE START SWITCH

1. Start switch shall be engine pressure sensing type capable of recognizing the output pressure of any type of motor vehicle. Electrical contact shall be dry type or not exceed 24V.

I. PUSH TO STOP BUTTON

1. Shall be Allen Bradley illuminated amber contact push button. This device shall meet UL Type 4X rating. Indicator light/start button shall be mounted on the enclosure cover and be identified by engraved ledger plate.

J. WIRING

1. Wiring shall be run in wire channel to allow for easier identification of wiring circuit and appearance. All wiring circuitry shall meet UL listed for proper bending radiuses and terminations.

K. TERMINAL BLOCK

1. Shall be 600 V, UL rated, recognized and shall provide individual connection points for remote controls, power and motor connections.

L. WIRING IDENTIFICATION

1. Shall be computer generated and identify all terminals, fuses, contactors, on both supply and termination points.

M. LABELING

1. Shall be provided and secured permanently to the exterior of electrical controller, indicating the manufacturer, his address and telephone number. The cover shall also have user instructions and any warnings or cautions required by Underwriter Laboratories.

N. ELECTRICAL WIRING SCHEMATIC

1. Wiring schematic shall be provided with each electrical control box supplied. Wiring schematic shall show internal circuitry as well as all primary and secondary connections to the controller. This schematic shall be provided as a "D" print drawing to the department.

O. ELECTRICAL INTERFERENCE

1. It is in the department's best interest to reject any design of electrical controller which utilizes or produces electrical frequency transmission or any possibility of electrical backfeed which may interfere with a central services communication or onboard vehicle computer logic or navigational equipment.

PART 3 EXECUTION

3.1 INSTALLATION

A. The Emergency Vehicle Exhaust System shall be installed by the local certified installer.

END OF SECTION 23.3516

SECTION 23.3600 - AIR TERMINAL UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Variable volume terminal units.

B. Integral heating coils.

1.2 RELATED REQUIREMENTS

A. Section 23 2113 - Hydronic Piping: Connections to heating coils.

B. Section 23 2114 - Hydronic Specialties: Connections to heating coils.

C. Section 23 3100 - HVAC Ducts and Casings.

D. Section 23 3300 - Air Duct Accessories.

1.3 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilation Systems; National Fire Protection Association; 2018.

B. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate air flow, static pressure, and NC designation. Include electrical characteristics and connection requirements.

C. Shop Drawings: Indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.

1. Include schedules listing discharge and radiated sound power level for each of second through sixth octave bands at inlet static pressures of 1 to 4 inch wg.

D. Manufacturer's Installation Instructions: Indicate support and hanging details, and service clearances required.

E. Project Record Documents: Record actual locations of units.

F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and complete parts lists. Include directions for resetting constant volume regulators.

G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.6 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide warranty for a period of one year from the date of substantial completion of the entire project.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Nailor.

B. Trane.

C. Johnson Controls.

D. Carrier.

E. Daikin.

2.2 MANUFACTURED UNITS

A. Ceiling mounted variable air volume supply air control terminals for connection to single duct, central air systems, with electronic variable volume controls, hot water heating coils.

B. Identify each terminal unit with clearly marked identification label and air flow indicator. Include unit nominal air flow, maximum factory set airflow, minimum factory set air flow, and coil type.

2.3 SINGLE DUCT VARIABLE VOLUME UNITS

A. Basic Assembly:

1. Casings: Minimum 22 gage galvanized steel.
2. Lining: Minimum 1" inch thick closed cell foam insulation. Insulation shall conform to UL 181 for erosion and NFPA 90A for fire, smoke and melting, and comply with a 25/50 Flame Spread and Smoke Developed Index per ASTM E-84 or UL 723. Additionally, insulation shall comply with Antimicrobial Performance Rating of 0, no observed growth, per ASTM G-21. Polyethylene insulation is not acceptable.
3. Plenum Air Inlets: Round stub connections for duct attachment.
4. Plenum Air Outlets: S slip and drive connections.

B. Basic Unit:

1. Configuration: Air volume damper assembly inside unit casing. Locate control components inside protective metal shroud.
2. Volume Damper: Construct of galvanized steel with peripheral gasket and self-lubricating bearings; maximum damper leakage: 2 percent of design air flow at 1 inches rated inlet static pressure.

C. Hot Water Heating Coil:

1. Construction: 1/2 inch copper tube mechanically expanded into aluminum plate fins, leak tested under water to 200 psig pressure, factory installed.

D. Automatic Damper Operator:

1. Electric Actuator: 24 volt with high limit.

E. Provide factory mounting and wiring of controls. Controls shall be provided by the ATC Contractor.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Support units individually from structure. Do not support from adjacent ductwork.

C. Connect to ductwork in accordance with Section 233100.

END OF SECTION 23.3600

SECTION 23.3700 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Diffusers.

B. Registers/grilles.

C. Vents.

D. Roof Hoods.

1.2 REFERENCES

A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; Air Movement and Control Association International, Inc.; 2007.

B. ARI 890 - Standard for Air Diffusers and Air Diffuser Assemblies; Air-Conditioning and Refrigeration Institute; 2008.

C. ASHRAE Std 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets; American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.; 2006.

D. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

1.3 SUBMITTALS

A. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

B. Project Record Documents: Record actual locations of air outlets and inlets.

1.4 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Kreuger.

B. Price.

C. Titus.

2.2 RECTANGULAR CEILING DIFFUSERS

A. Description: A square or rectangular inlet shall be an integral part of the frame assembly and a transition piece shall be available to facilitate attachment of round duct. An inner core assembly consisting of fixed deflection louvers shall be available in one-, two-, three- or four-way horizontal discharge patterns. Steel or aluminum induction blades shall be welded to each wing of the inner core. The induction blades shall be oriented at 45° angles in opposite directions to ensure rapid mixing of primary and room air. The inner core assembly must be removable in the field without tools for easy installation, cleaning or damper adjustment.

B. Frame: Surface mount type. In ACT, where outer dimensions are 18x18 or greater, lay-in type shall be used.

C. Color: As shown on drawings.

D. Damper: Optional damper shall be constructed of heavy gauge steel or aluminum. Damper must be operable from the face of the diffuser by removing the spring loaded inner core assembly.

2.3 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

A. Description: Grilles shall have 3/4-inch blade spacing. The fixed deflection blades shall be available parallel to the long or short dimension of the grille. Construction shall be of extruded steel or aluminum with a 1¼-inch wide border on all sides. Minimum border thickness shall be 0.040-0.050 inch. Sizes 24 x 24 inches and smaller shall be constructed using a roll-formed frame. Corners shall be welded with full penetration resistance welds. Sizes larger than 24 x 24 inches shall be constructed by using heavy steel or aluminum extrusions and shall be interlocked at the four corners and mechanically staked to form a rigid frame. Screw holes shall be counter-sunk for a neat appearance. Deflection blades shall be contoured to a specifically designed and tested cross-section to meet published test performance data. Blades shall be firmly held in place by mullions from behind the grille and fixed in place by crimping or welding. Blade deflection angle shall be available at 35°.

B. Frame: Surface mounted with countersunk screw mounting. In ACT, where nominal dimensions are 18x18 or greater, lay-in type shall be used.

C. Color: As shown on drawings.

D. Damper: Optional opposed blade volume damper shall be constructed of heavy gauge steel or aluminum. Damper must be operable from the face of the grille.

2.4 HEAVY DUTY RETURN GRILLES

A. Description: Steel return bar grilles shall have 1/2-inch bar spacing and 38° deflection. The fixed deflection bars shall be available parallel to the long or short dimension of the grille. Construction shall be of steel with a 1¼-inch border width on all sides and a minimum border gauge thickness of 16; bars shall be 14-gauge steel. Bars shall be reinforced by perpendicular, steel support bars spaced on 6-inch maximum centers. Corners shall be welded with full penetration resistance welds with a reinforcing patch for extra strength. Screw holes shall be countersunk for a neat appearance.

B. Frame: Surface mounted with countersunk screw mounting.

C. Color: As shown on drawings.

2.5 WALL SUPPLY REGISTERS/GRILLES

A. Type: Supply grilles shall be double deflection. The deflection blades shall be available parallel to the long dimension of the grille or register. Construction shall be of steel or aluminum with a 1¼-inch wide border on all sides. Sizes 24 x 24 inches and below shall have roll-formed borders with a minimum thickness of 0.032 inch. Larger sizes shall be constructed using continuous steel or aluminum extrusions with a nominal thickness of 0.040 through 0.050 inch and shall be interlocked at the four corners and mechanically staked to form a rigid frame. Screw holes shall be countersunk for a neat appearance. Deflection blades shall be contoured to a specifically designed and tested cross-section to meet published test performance data. Blades shall be spaced on 3/4-inch centers. Blades shall have friction pivots on both sides to allow individual blade adjustment without loosening or rattling or be inserted through the frame and held tight with steel friction wire interlocked to the frame on both ends of each side. Plastic blade pivots are not acceptable.

B. Frame: Surface mounted with countersunk screw mounting.

B. Damper: Optional opposed blade volume damper shall be constructed of heavy gauge steel or aluminum. Damper must be operable from the face of the grille.

2.6 LINEAR SLOT DIFFUSERS

A. Fabrication: Linear slot diffusers shall have slot spacing of the sizes and mounting types shown on the plans. Linear slot diffusers shall be available in standard one piece lengths up to 6 feet and 1 to 8 discharge slots. Diffuser lengths greater than 6 feet shall be furnished in multiple sections and will be joined together end-to-end with alignment pins to form a continuous slot appearance. All alignment components to be provided by the manufacturer.

B. Frame: The frame and support bars shall be constructed of heavy gauge extruded aluminum. The pattern controller shall be an aerodynamically curved “ice-tong” shaped steel deflector capable of 180° pattern adjustment from the face of the diffuser and shall allow dampering if required. Maximum pattern controller length shall be 3 feet, for diffusers longer than 3 feet pattern controllers shall be furnished in multiple sections. Surface mount type with countersunk screw mounting for hard ceilings or lay-in mount type for ACT.

C. Color: The face finish shall be as shown on the drawings and the pattern colors shall have a black finish.

D. Accessories: Heavy gauge extruded aluminum end borders, end caps and mitered corners shall be available to close off the ends of the diffusers. Plenums shall be manufactured by the same manufacturer of the linear slot diffusers.

2.7 VENTS

A. Dryer/Kiln Exhaust Termination: Provide Tjernlund Products, Inc. Model VH1-3 sidewall vent hood or equal.

2.8 ROOF HOODS

A. General Description:

1. Ventilator is low silhouette for intake/relief applications.

B. Hood and Base:

1. Material Type: Aluminum.
2. Hood Constructed of precision formed, arched panels with interlocking seams.
3. Vertical end panels are fully locked into hood end panels.
4. Base height is standard of 5 inches.
5. Curb cap is six inches larger then throat size.
6. Curb cap has pre-punched mounting holes for installation.

C. Birdscreen:

1. Constructed of ½ inch Aluminum mesh.

2. Mounted horizontally across the intake area of the hood.

D. Hood Support:

1. Constructed of galvanized steel and fastened so the hood can either be removed completely from the base or hinged open.

E. Options/Accessories:

1. Roof Curbs:

a. Type: Welded, straight sided curb.
b. Material: Aluminum.
c. Insulation thickness: 2 inches.
d. Height: 18 inches.

2. Dampers:

a. Type: As noted on the drawings.
b. Prevents outside air from entering back into the building when fan is off
c. Balanced for minimal resistance to flow
d. Galvanized frames with pre-punched mounting holes

3. Insect Screen:

a. Constructed of fine mesh aluminum
b. Fitted to the top of the throat and prevents entry of insects

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location and sizes of outlets and inlets and make necessary adjustments in position and/or size to conform with architectural features, symmetry, lighting arrangement, and ceiling grid.

C. Ceiling grilles and registers shall fit in tiles without infringing on the ceiling grid. Any discrepancies shall be reported prior to ordering the inlet/outlet.

D. Install diffusers to ductwork with air tight connection.

E. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

F. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 099000.

END OF SECTION 23.3700

SECTION 23.3750 – WALL LOUVERS

PART 1 GENERAL

1.1 SUMMARY

A. This section includes fixed, extruded-aluminum louvers.

B. Related Sections include the following:

1. Division 07 Section "Joint Sealants": Sealants installed in perimeter joints between louver frames and adjoining construction.

1.2 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.3 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Provide louvers that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg. F., ambient; 180 deg. F., material surfaces.

B. Air-Performance, Water-Penetration, Air-Leakage, and Wind-Driven Rain Ratings: Provide louvers complying with performance requirements indicated, as demonstrated by testing manufacturer's sock units identical to those provided, except for length and width according to AMCA 500-L.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other Work. Show blade profiles, angles, and spacing.

C. Samples for Verification: For each type of metal finish required.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain louvers through one source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.2, “Structural Welding Code—Aluminum”.

C. SMACNA Standard: Comply with recommendations in SMACNA’s “Architectural Sheet Metal Manual” for fabrication, construction details, and installation procedures.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify louver openings by field measurements before fabrication and indicate measurement on Shop Drawings. Coordinate the requirements of the recessed flange installation with G.C.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating louvers without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck; Model ESD-603.
2. Pottorf; Model EFD-637.
3. Ruskin Company; Model ELF6375DX.

2.2 MATERIALS

A. Aluminum Extrusions: ASTM B 221, alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B 209, alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Of same basic metal and alloy as fastened metal or 300 Series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.

1. Use types and sizes to suit unit installation conditions.
2. Use Phillips flat-head screws for exposed fasteners, unless otherwise indicated.

D. Post-installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads for imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.3 FABRICATION, GENERAL

A. Assemble louvers in factory in minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Maintain equal louver blade spacing to produce uniform appearance.

C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

D. Include supports, anchorages, and accessories required for complete assembly.

E. Provide subsills made of same material as louvers.

F. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer, concealed from view, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.4 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Drainable-Blade Louver:

1. Louver Depth: 6 inches.
2. Frame and Blade Nominal Thickness: As required to comply with structural performance requirements, but not less than 0.80 inch.
3. Louver Blades: 45 degree slope with center baffle, return bend, and continuous blade reinforcing.
4. Mullion Type: Concealed structural mullions.
5. Free Area: Not less than 8.0 sq.ft. for 48-inch-wide by 48-inch high louver.
6. Frame construction shall contain integral flanges, to be mounted within brick courses. Coordinate the requirements with the G.C. prior to ordering.

2.5 LOUVER SCREENS

A. General: Provide screen at interior face of each exterior louver.

1. Screening Type: Bird screening for louvers connected to ducts; insect screening for louvers not connected to ducts.

B. Secure screens to louver frames with stainless-steel machine screws, spaces a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same kind and form of metal as indicated for louver to which screens are attached.
2. Finish: Same finish as louver frames to which louver screens are attached.
3. Type for Bird Screening: Non-rewireable frame with a driven spline or insert for securing screen mesh.
4. Type for Insect Screening: Rewirable frame with a driven spline or insert for securing screen mesh.

D. Louver Screening:

1. Bird Screening: Aluminum, ½-inch-square mesh, 0.063-inch wire.
2. Insect Screening: Stainless steel, 18-by-18 mesh, 0.009-inch wire.

2.6 BLANK-OFF PANELS

A. Insulated Blank-off Panels: Laminated metal-faced panels consisting of insulating core surfaced on back and front with metal sheets.

1. Thickness: 2 inches unless otherwise indicated.
2. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch nominal thickness.
3. Insulating Core: Unfaced mineral-fiber or foamed-plastic rigid insulation board.

4. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard extruded-aluminum-channel frames, not less than 0.080-inch nominal thickness, with corners mitered and with same finish as panels.
5. Seal perimeter joints between panel faces and louver frames with 1/8-by-1-inch PVC compression gaskets.
6. Panel Finish: Same type of finish applied to louvers, but black color.
7. Attach blank-off panels of louver frames with clips or stainless-steel, sheet metal screws.

2.7 ALUMINUM FINISH

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products for recommendations for applying and designating finishes.

B. Finish louvers after assembly.

C. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.

D. High-Performance Organic-Coating Finish: AA-C12C42R1 x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Fluoropolymer Two-Coat Coating system: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
2. Color: Custom color to match Architect's sample.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or led washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fittings joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes to no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

F. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 07 Section “Joint Sealants” for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

A. Clean exposed surfaces of louvers that are not protected by temporary covering, to remote fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surface and dry.

C. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 23.3750

SECTION 23.4000 – HVAC AIR CLEANING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Disposable panel filters.

1.2 RELATED SECTIONS

A. Section 01 5000 - Temporary Facilities and Controls: Filters for temporary heating and ventilating.

B. Refer to the requirements of Division 1 and coordinate the division of responsibility of the work with Section 01 1000 – Summary of the Project.

1.3 REFERENCES

A. ARI 850 - Commercial and Industrial Air Filter Equipment; Air-Conditioning and Refrigeration Institute; 2004.

B. ASHRAE Std 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 1992.

C. UL 900 - Standard for Air Filter Units; Underwriters Laboratories Inc.; 2004.

1.4 PERFORMANCE REQUIREMENTS

A. Conform to ARI 850 Section 7.4.

1. Dust Spot Efficiency: Plus or minus 5 percent.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on filter media, filter performance data, filter assembly and filter frames, dimensions, motor locations and electrical characteristics and connection requirements.

C. Shop Drawings: Indicate filter assembly and filter frames, dimensions, motor locations, and electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Indicate assembly and change-out procedures.

E. Operation and Maintenance Data: Include instructions for operation, changing, and periodic cleaning.

1.6 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.7 EXTRA MATERIALS

A. See Section 01 6000 - Product Requirements, for additional provisions.

B. Provide two sets of disposable filters for each piece of HVAC equipment requiring air filters.

PART 2 PRODUCTS

2.1 DISPOSABLE PANEL FILTERS

A. Manufacturers:

1. American Filtration Inc: www.americanfiltration.com.
2. Camfil Farr Company: www.camfilfarr.com.

B. Media: UL 900 Class 2, fiber blanket, factory sprayed with flameproof, non-drip, non-volatile adhesive.

1. Nominal Size: 24 x 24 inches (610 x 610 mm).
2. Thickness: 2 inch (50 mm).

C. Performance Rating:

1. MERV Rating: 13.
2. Face Velocity: 500 FPM (2.54 m/sec).
3. Initial Resistance: less then 0.40 inch WG
4. Recommended Final Resistance: 2x initial pressure drop.

D. Filter Frame: High wet strength beverage board.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install air cleaning devices in accordance with manufacturer's instructions.

B. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.

C. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with clean set.

END OF SECTION 23.4000

SECTION 23.5233 – CONDENSING BOILERS

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Section 23 2114 - Hydronic Specialties.

B. Section 23 0923 – Direct Digital Control (DDC) System.

C. Section 23 0993 - HVAC Control Sequence.

D. Refer to the requirements of Division 1 and coordinate the division of responsibility of the work with Section 01 1000 – Summary of the Project.

1.2 REFERENCES

A. ASME Section IV

B. CAN-1.3.1-77, Industrial and Commercial Gas Fired Packaged Boilers

C. CSD-1, Controls and Safety Devices

D. XL GAPS

E. NEC, National Electric Code

F. UL-795 7th Edition

G. AHRI, BTS-2000

H. ASHRAE 90.1

1.3 SUBMITTALS

A. Product Data: Include performance data, operating characteristics, technical product data, rated capacities of selected model, weights (shipping, installed and operating), installation and start-up instructions, and furnished accessory information.

B. Shop Drawings: For boiler, standard boiler trim and accessories.

1. End Assembly Drawing: Detail overall dimensions, connection sizes, connection locations, and clearance requirements.

2. Wiring Diagrams: Detail electrical requirements for the boiler including ladder type wiring diagrams for power, interlock and control wiring. Clearly differentiate between portions of wiring that are factory installed and portions to be field installed.

C. Certificate of Product Rating: Submit AHRI Certificate indicating Thermal Efficiency, Combustion Efficiency, Materials of Construction, Input, and Gross Output conform to the design basis.

D. Thermal efficiency curves: Submit thermal efficiency curves between and including minimum and maximum rated capacities, for return water temperatures ranging from 80°F to 180°F.

E. Water side pressure drop curve.

F. Flue gas temperature curves: Submit flue gas temperature curves for minimum and maximum boiler capacity, for return water temperatures ranging from 80°F to 160°F.

1. If submitted flue gas temperatures, minimum or maximum inputs are different from that of the basis of design manufacturer and model, the manufacturer shall be responsible for draft calculations and reselection of the flue gas exhaust system.

G. Source quality-control test reports.

H. Field quality-control test reports: Start-up by a factory authorized service company.

I. Operation and Maintenance Data: Data to be included in Installation and Operation Manual.

J. Warranty: Standard warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firms regularly engaged in the manufacture of condensing hydronic boilers with welded steel pressure vessels, whose products have been in satisfactory use in service for not less than twenty-five (25) years. The manufacturer must be headquartered in North America and manufacture pressure vessels in an ASME-certified facility wholly owned by the manufacturer. The specifying engineer, contractor and end customer must have the option to visit the factory to witness test fire and other relevant procedures.

B. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code, Section IV “Heating Boilers”, for a maximum allowable working pressure of 160 PSIG.

D. CSD-1 Compliance: The boiler shall comply with ASME Controls and Safety Devices for Automatically Fired Boilers (CSD-1).

E. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."

F. UL Compliance: Boilers must be tested for compliance with UL 795, "Standard for Commercial-Industrial Gas Heating Equipment." Boilers shall be listed and labeled by ETL.

G. AHRI Compliance: Boilers shall be tested and rated according to the BTS-2000 test standard and verified by AHRI.

H. The equipment shall be of the type, design, and size that the manufacturer currently offers for sale and appears in the manufacturer's current catalog.

I. The equipment shall fit within the allocated space, leaving ample allowance for maintenance and inspection.

J. The equipment shall be new and fabricated from new materials. The equipment shall be free from defects in materials and workmanship.

K. In order to provide unit responsibility for the specified capacities, efficiencies, and performance, the boiler manufacturer shall certify in writing that the equipment being submitted shall perform as specified.

1.5 COORDINATION

A. Mechanical contractor shall coordinate the size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete reinforcement and formwork requirements are specified in Division 03.

1.6 WARRANTY

A. See Section 01 7700 - Closeout Submittals, for additional warranty requirements.

B. Standard Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period provided the boiler is installed, controlled, operated and maintained in accordance with the Installation, Operation and Maintenance Manual.

1. Warranty Period for the Pressure Vessel and Heat Exchanger: The boiler manufacturer shall warranty against failure due to:

    a. Flue gas condensate corrosion, and/or defective material or workmanship for a period of ten (10) years, non-prorated, from the date of shipment from the factory.
    b. Thermal shock for the lifetime of the boiler.

2. Warranty Period for the Burner: The boiler manufacturer shall warranty the mesh burner head against defective material or workmanship for a period of five (5) years, non-prorated, from the date of shipment from the factory.
3. Warranty Period for all other components: The boiler manufacturer will repair or replace any part of the boiler that is found to be defective in workmanship or material for a period of two (2) years, non-prorated, from the date of shipment from the factory.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Weil-Mclain.

B. Lochinvar.

C. Pre-approved equal.

2.2 BOILER CONSTRUCTION

A. Boiler(s) heat exchanger:

1. Fire-tube stainless steel heat exchanger.
2. The boiler must have non-metallic condensate collector to capture condensate from both, the vent system and heat exchanger.

B. Factory Assembled and Tested.

C. Boiler(s) main components:

1. The combustion chamber will be sealed and located at the top which will be of counter flow design to assure that sediment and any lime that might form will fall to the bottom away from the crown sheet area.
2. Boiler(s) shall be supplied with a gas valve designed with negative pressure regulation (fan venturi effect "pulls" gas through valve rather than gas pressure “pushing” gas through valve). Negative pressure regulation enables the boiler to operate in a safe condition at 3.5” W.C. inlet gas pressure. The inlet (natural or propane) gas pressure to the boiler gas valve should be a minimum of 3.5” W.C. and a maximum of 14” W.C. If inlet gas pressure exceeds 13” W.C., a 100% lock-up type gas pressure regulator of adequate size must be installed in gas supply piping and adjusted to prevent pressure in excess of 13” W.C.
3. The burner shall be premix combustion type, made with stainless steel and a woven metal fiber outer covering to provide a wide range of modulating firing rates.
4. The boiler shall be equipped with a variable speed blower system capable of modulating the boiler firing rate.

5. The boiler shall be equipped with a device capable of controlling the air/fuel ratio through a 10 to 1 fturndown ratio.
6. The control system shall have an electronic display for boiler set-up, boiler status, and boiler diagnostics.
7. Taco ECM circulator.

2.3 VENTING AND COMBUSTION AIR

A. Boiler(s) must be capable of using outside air piped directly to boiler for combustion. Inlet and termination of these pipes must be connected to either through-the-roof or sidewall terminations as recommended by the manufacturer.

B. Internal vent pipe must be non-metallic.

C. The boiler shall be direct vent using SS.

2.4 BOILER TRIM

A. All electrical components to be of a high quality.

B. Water boiler(s) controls furnished:

1. High limit temperature control with manual reset (190 degrees F maximum allowable boiler water temperature).
2. Combination pressure-temperature gauge. Gauge dial clearly marked and easy to read.
3. ASME certified pressure relief valve.
4. Flue gas, outlet water temperature, and return water temperature sensors.
5. Low water protection with manual reset.
6. Built-in freeze protection.

C. Boiler Control to be UL 353 Listed with:

1. Built-in MODBUS communication.
2. 4 circulator contacts.
3. Auxiliary input/output capability.
4. Variable temperature zones that require no mixing valves.
5. 3 thermostat inputs.
6. Outdoor reset for each priority.
7. Zone and priority based setup options.
8. 2 Network and 2 local priorities available on each cascaded boiler.
9. Flue gas, outlet water temperature, and return water temperature sensors.
10. LCD display and 5 button interface.
11. Alarm contact that triggers during manual lockout, flame failure, high temperature limit and low water cut off.
12. Remote modulation capable of interfacing with Building Automation Systems and Multiple Boiler Systems.

13. Ability to control additional heat demand.

2.5 BOILER MANUALS

A. The boiler(s) shall be provided with complete instruction manuals, including:
   1. Boiler Installation Manual.
   2. User's Manual.

PART 3 EXECUTION

3.1 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.

C. Connect gas piping to boiler gas train inlet with isolation valve and union. Piping shall be at least full size of gas train connection. Provide a reducer if required.

D. Connect hot water supply and return water connections with shutoff valve and union or flange at each connection.

E. Install piping from safety relief valves to the nearest floor drain.

F. Install piping from flue gas condensate drain connection to the condensate drain trap and to the nearest floor drain.

G. Boiler Venting:

   1. Install flue venting and combustion air-intake.
   2. Connect to boiler connections, flue size and type as recommended by the manufacturer.

H. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

I. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. After boiler installation is completed, the manufacturer shall provide the services of a field representative to inspect components, assemblies, and equipment installations, including connections and provide startup of the boiler and training to the operator.
2. Arrange with National Board of Boiler and Pressure Vessel Inspectors for inspection of boilers and piping. Obtain certification for completed boiler units, deliver to Owner, and obtain receipt.

B. Tests and inspections:

1. Perform installation and startup checks according to manufacturer's written instructions.
2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.

    a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level and water temperature.
    b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Remove and replace malfunctioning units and retest as specified above.

D. Occupancy Adjustments: When requested within 12 months of startup, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to 2 visits to Project during other than normal occupancy hours for this purpose.

END OF SECTION 23.5233

SECTION 23.7416 - PACKAGED ROOFTOP AIR HANDLING UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Packaged Rooftop Air Handling Units (RTUs & ERUs).

1.2 RELATED SECTIONS

A. Section 23 0513 - Common Motor Requirements for HVAC Equipment.

B. Section 23 0514 – Variable Frequency Drives.

C. Section 23 3300 - Air Duct Accessories: Flexible duct connections.

D. Section 23 0993 – HVAC Controls Sequence.

1.3 REFERENCES

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; American Bearing Manufacturers Association, Inc.; 1990 (Reapproved 2000).

B. ABMA STD 11 - Load Ratings and Fatigue Life for Roller Bearings; American Bearing Manufacturers Association, Inc.; 1990 (Reapproved 1999).

C. AMCA 99 - Standards Handbook; Air Movement and Control Association International, Inc.; 2003.

D. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating; Air Movement and Control Association International, Inc.; 2007 (ANSI/AMCA 210, same as ANSI/ASHRAE 51).

E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; Air Movement and Control Association International, Inc.; 2008.

F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; Air Movement and Control Association International, Inc.; 2006.

G. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; Air Movement and Control Association International, Inc.; 2007.

H. ARI 410 - Standard for Forced-Circulation Air-Cooling and Air-Heating Coils; Air Conditioning and Refrigeration Institute; 2001 (R2005).

I. ARI 430 - Standard for Central-Station Air-Handling Units; Air-Conditioning and Refrigeration Institute; 2009.

J. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2009, Revision 1 - 2010.

K. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.

L. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

M. UL (EAUED) - Electrical Appliance and Utilization Equipment Directory; Underwriters Laboratories Inc.; current edition.

N. UL 900 - Standard for Air Filter Units; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data:

1. Published Literature: Indicate dimensions, weights, capacities, ratings, gages and finishes of materials, and electrical characteristics and connection requirements.
2. Filters: Data for filter media, filter performance data, filter assembly, and filter frames.
3. Fans: Performance and fan curves with specified operating point clearly plotted, power, RPM.
4. Sound Power Level Data: Fan outlet and casing radiation at rated capacity.
5. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

C. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

D. Manufacturer's Instructions: Include installation instructions.

E. Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum ten years of documented experience.

B. Unit shall be safety certified by ETL and ETL US listed. Unit nameplate shall include the ETL/ETL Canada label.

1.6 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.

B. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

C. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.8 EXTRA MATERIALS

A. See Section 01 6000 - Product Requirements, for additional provisions.

B. Supply two sets of filters for each unit.

1.9 WARRANTIES

A. The units shall be warranted by the manufacturer against defects in material and factory workmanship for one year. A minimum (5) five year compressor warranty shall be provided. First year of warranty shall include parts and labor. The warranties shall begin when the building has been determined to be substantially complete.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Aaon.

B. Daikin.

C. Valent.

D. Addison.

2.2 RTU-1, 3, 4, 5, & 6:

A. General Description

1. Packaged rooftop unit shall include:

a. Evaporator coils
b. Filters
c. Supply fans
d. Dampers
e. Variable capacity compressors
f. Air-cooled condenser coils and condenser fans
g. Reheat coil
h. Gas heaters
i. Unit controls

2. Unit shall be factory assembled and tested including leak testing of the DX coils, pressure testing of the refrigeration circuit, and run testing of the completed unit. Run test report shall be supplied with the unit in the service compartment's literature pocket.
3. Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.
4. Unit components shall be labeled, including refrigeration system components and electrical and controls components.
5. Estimated sound power levels (dB) shall be shown on the unit ratings sheet.
6. Installation, Operation, and Maintenance manual shall be supplied within the unit.
7. Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's hinged access door.
8. Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's hinged access door.

B. Construction

1. All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.
2. Unit insulation shall have a minimum thermal resistance R-value of 16. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D-1929-11 for a minimum flash ignition temperature of 610°F.
3. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, reduces heat transfer through the panel, and prevents exterior condensation on the panel.

4. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in

AHRI Standard 340/360. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage. Deflection shall be measured at the midpoint of the panel height and width. Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.

5. Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.
6. Access to filters, dampers, cooling coils, reheat coil, heaters, compressors, and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles. Full length stainless steel piano hinges shall be included on the doors.
7. Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.
8. Units with cooling coils shall include double sloped 304 stainless steel drain pans.
9. Unit shall be provided with bottom discharge and bottom return air openings. Openings shall have upturned flanges of at least 1/2 inch in height around the opening.
10. Unit shall include lifting lugs on the top of the unit.
11. Unit shall include factory installed, painted galvanized steel condenser coil guards on the face of the condenser coil.

C. Electrical

1. Unit shall be provided with factory installed and factory wired, non-fused disconnect switch.
2. Unit shall have a 10 kAIC SCCR.
3. Unit shall be provided with a factory installed and factory wired 115V, 12 amp GFI outlet disconnect switch in the unit control panel.
4. Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more than 10% out of balance on voltage, the voltage is more than 10% under design voltage or on phase reversal.

D. Supply Fans

1. Unit shall include direct drive, unhoused, backward curved, plenum supply fans.
2. Blowers and motors shall be dynamically balance and mounted on rubber isolators.
3. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
4. Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be premium efficiency.
5. Unit shall include barometric relief dampers.

E. Cooling Coils

1. Evaporator Coils

a. Coils shall be designed for use with R-454B refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.
b. Coil shall be standard capacity.
c. Coils shall be hydrogen or helium leak tested.

d. Coils shall be furnished with factory installed expansion valves.

F. Refrigeration System

1. Unit shall be factory charged with R-454B refrigerant.
2. Compressors shall be scroll type with thermal overload protection and carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory.
3. Compressors shall be mounted in an isolated service compartment which can be accessed without affecting unit operation. Lockable hinged compressor access doors shall be fabricated of double wall, rigid polyurethane foam injected panels to prevent the transmission of noise outside the cabinet.
4. Compressors shall be isolated from the base pan with the compressor manufacturer's recommended rubber vibration isolators, to reduce any transmission of noise from the compressors into the building area.
5. Each refrigeration circuit shall be equipped with expansion valve type refrigerant flow control.
6. Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides and a factory installed liquid line filter driers.
7. Unit shall include a variable capacity scroll compressor on the refrigeration circuit which shall be capable of modulation from 10-100% of its capacity.
8. Refrigeration circuit shall be provided with hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a control signal terminal which allow the unit to have a dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space.
9. Reheat coil shall be multi-pass and fabricated from aluminum microchannel tubes.
10. The factory installed controls shall include a 3 minute off delay timer to prevent compressor short cycling. The controls shall also include an adjustable, 20 second delay timer for each additional capacity stage to prevent multiple capacity stages from starting simultaneously and an adjustable compressor lock out.

G. Condensers

1. Air-Cooled Condenser

a. Condenser fans shall be a vertical discharge, axial flow, direct drive fans.
b. Coils shall be designed for use with R-454B refrigerant. Coils shall be multi-pass and fabricated from aluminum microchannel tubes.
c. Coils shall be designed for a minimum of 10°F of refrigerant sub-cooling.
d. Coils shall be hydrogen or helium leak tested.
e. Condenser fans shall be high efficiency electrically commutated motor driven with factory installed head pressure control module. Condenser airflow shall continuously modulate based on head pressure and cooling operation shall be allowed down to 35°F with adjustable compressor lockout.

H. Gas Heating

1. Stainless steel heat exchanger furnace shall carry a 25 year non-prorated warranty, from the date of original equipment shipment from the factory.
2. Gas furnace shall consist of stainless steel heat exchangers with multiple concavities, an induced draft blower and an electronic pressure switch to lockout the gas valve until the combustion chamber is purged and combustion airflow is established.

3. Furnace shall include a gas ignition system consisting of an electronic igniter to a pilot system, which will be continuous when the heater is operating, but will shut off the pilot when heating is not required.
4. Modulating Natural Gas Furnace shall be equipped with modulating gas valves, adjustable speed combustion blowers, stainless steel tubular heat exchangers, and electronic controller. Combustion blowers and gas valves shall be capable of modulation. Electronic controller includes a factory wired, field installed supply air temperature sensor. Sensor shall be field installed in the supply air ductwork. Supply air temperature setpoint shall be adjustable on the electronic controller within the controls Gas heater shall be capable of capacity turndown ratio as shown on the unit rating sheet.

I. Filters

1. Unit shall include 4 inch thick, pleated panel filters with an ASHRAE MERV rating of 13, upstream of the cooling coil. Unit shall also include 2 inch thick, pleated panel pre filters with an ASHRAE MERV rating of 8, upstream of the 4 inch standard filters.

J. Outside Air/Economizer

1. Unit shall include 0-100% economizer consisting of a motor operated outside air damper and return air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge seals and aluminum end seals. Damper blades shall be gear driven and designed to have no more than 20 cfm of leakage per sq ft. at 4 in. w.g. air pressure differential across the damper. Low leakage dampers shall be Class 2 AMCA certified, in accordance with AMCA Standard 511. Unit shall include outside air opening bird screen and outside air hood. Unit, except for horizontal series, shall also include barometric relief dampers.

a. Damper assembly shall be controlled by spring return enthalpy activated fully modulating actuator.

K. Controls

1. Factory Installed and Factory Provided Controller

a. Unit controller shall be capable of controlling all features and options of the unit. Controller shall be factory installed in the unit controls compartment and factory tested. Controller shall be capable of stand alone operation with unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling available without dependence on a building management system.

b. Controller shall have an onboard clock and calendar functions that allow for occupancy scheduling.
c. Controller shall include non-volatile memory to retain all programmed values without the use of a battery, in the event of a power failure.
d. Unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling shall be accomplished with connection to interface module with LCD screen and input keypad, interface module with touch screen, or with connection to PC with free configuration software. Controller shall be capable of connection with other factory installed and factory provided unit controllers with individual unit configuration, setpoint adjustment, sensor status viewing, and occupancy scheduling available from a single unit. Connection between unit controllers shall be with a modular cable. Controller shall be capable of communicating and integrating with a LonWorks or BACnet network. [Orion Controls System]

[RTU #4] Variable Air Volume Controller

1. [RTU #4] Unit shall utilize a variable capacity compressor system and a variable speed supply fan system to modulate cooling and airflow as required to meet space temperature cooling loads and to save operating energy. Supply fan speed shall modulate based on supply air duct static pressure. Cooling capacity shall modulate based on supply air temperature.
2. [RTU #4] With modulating hot gas reheat, unit shall modulate cooling and hot gas reheat as efficiently as possible, to meet space humidity loads and prevent supply air temperature swings and overcooling of the space.
3. [RTU #4] Unit shall modulate heating with constant airflow to meet space temperature heating loads. Modulating heating capacity shall modulate based on supply air temperature.

[RTU #1][RTU #3][RTU #5][RTU #6] Single Zone VAV Controller

1. Unit shall utilize a variable capacity compressor system and a variable speed fan system to modulate the cooling and airflow as required in meeting the space temperature needs and to save unit operating energy. Unit fan speed shall modulate based on space temperature, not supply air pressure.
2. [RTU #1][RTU #3][RTU #5][RTU #6] Units with modulating heat shall be capable of modulating fan speed in both the heating and cooling mode.
3. [RTU #1][RTU #3][RTU #5][RTU #6] With modulating hot gas reheat, unit shall modulate cooling and hot gas reheat as efficiently as possible, to meet space humidity loads and prevent supply air temperature swings and overcooling of the space.
4. Unit shall be provided with supply air temperature control. Mixing boxes and bypass ducts shall not be required for operation as a single zone VAV system.

L. Accessories

1. Unit shall be provided with a safety shutdown terminal block for field installation of a smoke detector which shuts off the unit's control circuit.
2. Unit shall be provided with a high condensate level switch that shuts down the unit when a high water level is detected in the drain pan.

2.3 RTU-2:

A. General Description

1. Packaged rooftop unit shall include:

a. Evaporator coils
b. Filters
c. Supply fans
d. Dampers
e. Variable capacity compressors
f. Air-cooled condenser coils and condenser fans
g. Reheat coil
h. Gas heaters
i. Unit controls

1. Unit shall be factory assembled and tested includingleak testing of the DX coils,pressure testing of the refrigeration circuit,and run testing of the completed unit. Run test report shall be supplied with the unit in the service compartment's literature pocket.
2. Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.
3. Unit components shall be labeled, includingrefrigeration system components andelectrical and controls components.
4. Estimated sound power levels (dB) shall be shown on the unit ratings sheet.
5. Installation, Operation and Maintenance manual shall be supplied within the unit.
6. Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's hinged access door.
7. Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's hinged access door.

B. Construction

1. All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.
2. Unit insulation shall have a minimum thermal resistance R-value of 16. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D-1929 for a minimum flash ignition temperature of 610°F.
3. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation,provides a cleanable interior, reduces heat transfer through the panel, and prevents exterior condensation on the panel.

4. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRI Standard 210/240.Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage. Deflection shall be measured at the midpoint of the panel height and width.Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.
5. Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.
6. Access to filters, dampers,cooling coil,reheat coil,heater,compressor,and electrical and controls components shall be through hinged access doors with quarter turn, lockable handles. Full length stainless steel piano hinges shall be included on the doors.
7. Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.
8. Units shall include double sloped 304 stainless steel drain pans.
9. Unit shall be provided with through the base vertical discharge and return air openings. All openings through the unit shall have upturned flanges of at least 1/2 inch around the opening.

10. Unit shall include lifting lugs on the top of the unit.

C. Electrical

1. Unit shall be provided with factory installed and factory wired, non-fused disconnect switch.
2. Unit shall have a 10 kAIC SCCR.
3. Unit shall be provided with a factory installed and factory wired 115V, 12 amp GFI outlet disconnect switch in the unit control panel.
4. Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more than 10% out of balance on voltage, the voltage is more than 10% under design voltage or on phase reversal.

D. Supply Fans

1. Unit shall include direct drive, unhoused, backward curved, plenum supply fans.
2. Blowers and motors shall be dynamically balanced.
3. Motor shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
4. Variable frequency drive shall be factory wired and mounted in the unit.

E. Cooling Coils

1. Evaporator Coils

a. Coils shall be designed for use with R-454B refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and aluminum end casings. Fin design shall be sine wave rippled.
b. Coil shall be standard capacity
c. Coils shall be helium hydrogen or helium leak tested.
d. Coils shall be furnished with factory installed thermostatic expansion valves.

F. Refrigeration System

1. Unit shall be factory charged with R-454B refrigerant.
2. Compressors shall be scroll type with thermal overload protection and carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory.
3. Compressors shall be mounted in an isolated service compartment which can be accessed without affecting unit operation. Lockable hinged compressor access doors shall be fabricated of double wall,rigid polyurethane foam injected panels to prevent the transmission of noise outside the cabinet.
4. Compressors shall be isolated from the base pan with the compressor manufacturer's recommended rubber vibration isolators, to reduce any transmission of noise from the compressors into the building area.
5. Each refrigeration circuit shall be equipped with thermostatic expansion valve type refrigerant flow control.
6. Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressureand low pressure sides, and a factory installed liquid line filter drier.

7. Unit shall include a variable capacity scroll compressor on the refrigeration circuit which shall be capable of modulation from 10-100% of its capacity.
8. Refrigeration circuit shall be provided with hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a control signal terminal which allow the unit to have a dehumidification mode of operation,which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space.
9. The factory installed controls shall include a 3 minute off delay timer to prevent compressor short cycling and an adjustable compressor lockout.

G. Condensers

1. Air-Cooled Condenser

a. Condenser fans shall be a vertical discharge, axial flow, direct drive fans.
b. Coils shall be designed for use with R-454B refrigerant.
c. Coils shall be multi-pass and fabricated from aluminum microchannel tubes.
d. Coils shall be designed for a minimum of 10°F of refrigerant sub-cooling.
e. Coils shall be hydrogen or helium leak tested.
f. Condenser fans shall be high efficiency electrically commutated motor driven with factory installed head pressure control module.Condenser airflow shall continuously modulate based on head pressure and cooling operation shall be allowed down to 35°F with adjustable compressor lockout.

H. Gas Heating

1. Stainless steel heat exchanger furnace shall carry a 25 year non-prorated warranty, from the date of original equipment shipment from the factory.
2. Gas furnace shall consist of stainless steel heat exchangers with multiple concavities, an induced draft blower and an electronic pressure switch to lockout the gas valve until the combustion chamber is purged and combustion airflow is established.
3. Furnace shall include a gas ignition system consisting of an electronic igniter to a pilot system, which will be continuous when the heater is operating, but will shut off the pilot when heating is not required.
4. Modulating Natural Gas Furnace shall be equipped with modulating gas valves, adjustable speed combustion blowers, stainless steel tubular heat exchangers, and electronic controller. Combustion blowers and gas valves shall be capable of modulation.Electronic controller includes a factory wired, field installed supply air temperature sensor. Sensor shall be field installed in the supply air ductwork. Supply air temperature setpoint shall be adjustable on the electronic controller within the controlsGas heater shall be capable of capacity turndown ratio as shown on the unit rating sheet.

I. Filters

1. Unit shall include 4 inch thick, pleated panel filters with an ASHRAE MERV rating of 13, upstream of the cooling coil.Unit shall also include 2 inch thick, pleated panel pre filters with an ASHRAE MERV rating of 8, upstream of the 4 inch standard filters.

J. Outside Air/Economizer

1. Unit shall include 0-100% economizer consisting of a motor operated outside air damper and return air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge

seals and aluminum end seals.Damper blades shall be gear driven and designed to have no more than 15 CFM of leakage per sq. ft. of damper area when subjected to 2 inches w.g. air pressure differential across the damper.Unit shall include outside air opening bird screen, outside air hood with rain lip and barometric relief dampers.

2. Damper assembly shall be controlled by spring return enthalpy activated fully modulating actuator.

K. Controls

1. Factory Installed and Factory Provided Controller

a. Unit controller shall be capable of controlling all features and options of the unit. Controller shall be factory installed in the unit controls compartment and factory tested.

b. Controller shall be capable of stand alone operation with unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling available without dependence on a building management system.

c. Controller shall have an onboard clock and calendar functions that allow for occupancy scheduling.

d. Controller shall include non-volatile memory to retain all programmed values without the use of a battery, in the event of a power failure. Unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling shall be accomplished with connection to interface module with LCD screen and input keypad,interface module with touch screen, or with connection to PC with free configuration software. Controller shall be capable of connection with other factory installed and factory provided unit controllers with individual unit configuration,setpoint adjustment, sensor status viewing, and occupancy scheduling available from a single unit. Connection between unit controllers shall be with a modular cable.Controller shall be capable of communicating and integrating with a LonWorks or BACnet network. [Orion Controls System]

Variable Air Volume Controller

1. Unit shall utilize a variable capacity compressor system and a variable speed supply fan system to modulate cooling and airflow as required to meet space temperature cooling loads and to save operating energy.Supply fan speed shall modulate based on supply air duct static pressure. Cooling capacity shall modulate based on supply air temperature.

2. With modulating hot gas reheat, unit shall modulate cooling and hot gas reheat as efficiently as possible, to meet space humidity loads and prevent supply air temperature swings and overcooling of the space.

3. Unit shall modulate heating with constant airflow to meet space temperature heating loads. Modulating heating capacity shall modulate based on supply air temperature.

L. Accessories

1. Unit shall be provided with a safety shutdown terminal block for field installation of a smoke detector which shuts off the unit's control circuit.

2.4 ERUs:

A. General Description

1. Packaged rooftop unit shall include:

a. Evaporator coils
b. Filters
c. Supply fans
d. Dampers
e. Variable capacity compressors
f. Air-cooled condenser coils and condenser fans
g. Reheat coil
h. Gas heaters
i. Exhaust fans
j. Energy recovery wheels
k. Unit controls

1. Unit shall be factory assembled and tested including leak testing of the DX coils, pressure testing of the refrigeration circuit, and run testing of the completed unit. Run test report shall be supplied with the unit in the service compartment's literature pocket.
2. Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.
3. Unit components shall be labeled, including refrigeration system components and electrical and controls components.
4. Estimated sound power levels (dB) shall be shown on the unit ratings sheet.
5. Installation, Operation, and Maintenance manual shall be supplied within the unit.
6. Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's hinged access door.
7. Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's hinged access door.

B. Construction

1. All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.
2. Unit insulation shall have a minimum thermal resistance R-value of 16. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D-1929-11 for a minimum flash ignition temperature of 610°F.
3. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, reduces heat transfer through the panel, and prevents exterior condensation on the panel.
4. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in

AHRI Standard 340/360. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage. Deflection shall be measured at the midpoint of the panel height and width. Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.

5. Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.
6. Access to filters, dampers, cooling coils, reheat coil, heaters, energy recovery wheels, compressors, and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles. Full length stainless steel piano hinges shall be included on the doors.
7. Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.
8. Units with cooling coils shall include double sloped 304 stainless steel drain pans.
9. Unit shall be provided with bottom discharge and bottom return air openings. Openings shall have upturned flanges of at least 1/2 inch in height around the opening.
10. Unit shall include lifting lugs on the top of the unit.
11. Unit shall include factory installed, painted galvanized steel condenser coil guards on the face of the condenser coil.

C. Electrical

1. Unit shall be provided with factory installed and factory wired, non-fused disconnect switch.
2. Unit shall have a 10 kAIC SCCR.
3. Unit shall be provided with a factory installed and factory wired 115V, 12 amp GFI outlet disconnect switch in the unit control panel.
4. Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more than 10% out of balance on voltage, the voltage is more than 10% under design voltage or on phase reversal.

D. Supply Fans

1. Unit shall include direct drive, unhoused, backward curved, plenum supply fans.
2. Blowers and motors shall be dynamically balance and mounted on rubber isolators.
3. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
4. Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be premium efficiency.

E. Exhaust Fans

1. Exhaust dampers shall be sized for 100% relief.
2. Fans and motors shall be dynamically balanced.
3. Unit shall include barometric relief dampers.
4. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
5. Access to exhaust fans shall be through double wall, hinged access doors with quarter turn lockable handles.

6. Unit shall include belt driven, unhoused, backward curved, plenum exhaust fans.
7. Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be premium efficiency.

F. Cooling Coils

1. Evaporator Coils

a. Coils shall be designed for use with R-454B refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.
b. Coils shall have interlaced circuitry and shall be standard capacity.
c. Coils shall be hydrogen or helium leak tested.
d. Coils shall be furnished with factory installed expansion valves.

G. Refrigeration System

1. Unit shall be factory charged with R-454B refrigerant.
2. Compressors shall be scroll type with thermal overload protection and carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory.
3. Compressors shall be mounted in an isolated service compartment which can be accessed without affecting unit operation. Lockable hinged compressor access doors shall be fabricated of double wall, rigid polyurethane foam injected panels to prevent the transmission of noise outside the cabinet.
4. Compressors shall be isolated from the base pan with the compressor manufacturer's recommended rubber vibration isolators, to reduce any transmission of noise from the compressors into the building area.
5. Each refrigeration circuit shall be equipped with expansion valve type refrigerant flow control.
6. Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides and a factory installed liquid line filter driers.
7. Lag refrigeration circuit shall be provided with hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a control signal terminal which allow the unit to have a dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space.
8. Reheat coil shall be multi-pass and fabricated from aluminum microchannel tubes.
9. The factory installed controls shall include a 3 minute off delay timer to prevent compressor short cycling. The controls shall also include an adjustable, 20 second delay timer for each additional capacity stage to prevent multiple capacity stages from starting simultaneously and an adjustable compressor lock out.

H. Condensers

1. Air-Cooled Condenser

a. Condenser fans shall be a vertical discharge, axial flow, direct drive fans.
b. Coils shall be designed for use with R-454B refrigerant. Coils shall be multi-pass and fabricated from aluminum microchannel tubes.
c. Coils shall be designed for a minimum of 10°F of refrigerant sub-cooling.
d. Coils shall be hydrogen or helium leak tested.

e. Condenser fans shall be high efficiency electrically commutated motor driven with factory installed head pressure control module. Condenser airflow shall continuously modulate based on head pressure and cooling operation shall be allowed down to 35°F with adjustable compressor lockout.

I. Gas Heating

1. Stainless steel heat exchanger furnace shall carry a 25 year non-prorated warranty, from the date of original equipment shipment from the factory.
2. Gas furnace shall consist of stainless steel heat exchangers with multiple concavities, an induced draft blower and an electronic pressure switch to lockout the gas valve until the combustion chamber is purged and combustion airflow is established.
3. Furnace shall include a gas ignition system consisting of an electronic igniter to a pilot system, which will be continuous when the heater is operating, but will shut off the pilot when heating is not required.

4. High Turndown Modulating Natural Gas Furnace shall be equipped with modulating gas valves, adjustable speed combustion blowers, stainless steel tubular heat exchangers, and electronic controller. Combustion blowers and gas valves shall be capable of modulation. Electronic controller includes a factory wired, field installed supply air temperature sensor. Sensor shall be field installed in the supply air ductwork. Supply air temperature setpoint shall be adjustable on the electronic controller within the controls compartment. Gas heater shall be capable of capacity turndown ratio as shown on the unit rating sheet. Heat trace shall be include on the condensate drain line.

J. Filters

1. Unit shall include 4 inch thick, pleated panel filters with an ASHRAE MERV rating of 13, upstream of the cooling coil. Unit shall also include 2 inch thick, pleated panel pre filters with an ASHRAE MERV rating of 8, upstream of the 4 inch standard filters.

K. Outside Air/Economizer

1. Unit shall include 0-100% economizer consisting of a motor operated outside air damper and return air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge seals and aluminum end seals. Damper blades shall be gear driven and designed to have no more than 20 cfm of leakage per sq ft. at 4 in. w.g. air pressure differential across the damper. Low leakage dampers shall be Class 2 AMCA certified, in accordance with AMCA Standard 511. Unit shall include outside air opening bird screen and outside air hood. Unit, except for horizontal series, shall also include barometric relief dampers.

    a. Damper assembly shall be controlled by spring return enthalpy activated fully modulating actuator.

L. Energy Recovery

1. Unit shall contain a factory mounted and tested energy recovery wheel(s). The energy recovery wheel(s) shall be mounted in a rigid frame containing the wheel drive motor, drive belt, wheel seals and bearings.
2. Wheel frame shall slide out for service and removal from the cabinet.

3. The energy recovery component shall incorporate a rotary wheel in an insulated cassette frame complete with seals, drive motor and drive belt.
4. The energy recovery cassette shall be an Underwriters Laboratories Recognized Component for electrical and fire safety. The wheel drive motor shall be an Underwriters Laboratory Recognized Component and shall be mounted in the cassette frame and supplied with a service connector or junction box. Thermal performance shall be certified by the manufacturer in accordance with ASHRAE Standard 84, Method of Testing Air-to-Air Heat Exchangers and AHRI Standard 1060, Rating Air-to-Air Energy Recovery Ventilation Equipment. Cassettes shall be listed in the AHRI Certified Products.

5. Energy recovery wheel cassette shall carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory. The first 12 months from the date of equipment startup, or 18 months from the date of original equipment shipment from the factory, whichever is less, shall be covered under the standard AAON limited parts warranty. The remaining period of the warranty shall be covered by Airxchange. The 5 year warranty applies to all parts and components of the cassette, with the exception of the motor, which shall carry an 18 month warranty. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided the Airxchange written instructions for Installation, Operation, and Maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts. Refer to the Airxchange Energy Recovery Cassette Limited Warranty Certificate.
6. Unit shall include 2 inch thick, pleated panel outside air filters with an ASHRAE MERV rating of 8, upstream of the wheels.
7. Hinged service access doors shall allow access to the wheel(s).
8. Aluminum Energy Recovery Wheels

a. Unit shall contain a factory mounted and tested monolithic aluminum energy recovery wheel with an inverter duty motor and a durable segmented link drive belt composite. Wheel frame shall be constructed with prime G90 hot-dip galvanized steel tested for corrosion resistance of 400 hours of salt spray.
b. Aluminum Energy recovery wheel shall be covered under the standard AAON limited parts warranty; the first 12 months from the date of equipment startup, or 18 months from the date of original equipment shipment from the factory, whichever is less. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided the written instructions for installation, operation and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts.
c. Total energy recovery wheels shall be made of corrugated aluminum with a 3A molecular sieve desiccant coating. Coated segments shall be cleanable with hot water or compressed air without degrading the latent recovery.

M. Controls

1. Factory Installed and Factory Provided Controller

a. Unit controller shall be capable of controlling all features and options of the unit. Controller shall be factory installed in the unit controls compartment and factory tested. Controller shall be capable of stand alone operation with unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling available without dependence on a building management system.

b. Controller shall have an onboard clock and calendar functions that allow for occupancy scheduling.
c. Controller shall include non-volatile memory to retain all programmed values without the use of a battery, in the event of a power failure. Unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling shall be accomplished with connection to interface module with LCD screen and input keypad, interface module with touch screen, or with connection to PC with free configuration software. Controller shall be capable of connection with other factory installed and factory provided unit controllers with individual unit configuration, setpoint adjustment, sensor status viewing, and occupancy scheduling available from a single unit. Connection between unit controllers shall be with a modular cable. Controller shall be capable of communicating and integrating with a LonWorks or BACnet network. [Orion Controls System]

Variable Air Volume Controller

1. Unit shall utilize a variable capacity compressor system and a variable speed supply fan system to modulate cooling and airflow as required to meet space temperature cooling loads and to save operating energy. Supply fan speed shall modulate based on supply air duct static pressure. Cooling capacity shall modulate based on supply air temperature.
2. With modulating hot gas reheat, unit shall modulate cooling and hot gas reheat as efficiently as possible, to meet space humidity loads and prevent supply air temperature swings and overcooling of the space.
3. Unit shall modulate heating with constant airflow to meet space temperature heating loads. Modulating heating capacity shall modulate based on supply air temperature.

N. Accessories

1. Unit shall be provided with a safety shutdown terminal block for field installation of a smoke detector which shuts off the unit's control circuit.
2. Unit shall be provided with a high condensate level switch that shuts down the unit when a high water level is detected in the drain pan.

PART 3 – EXECUTION

3.1 SHIPPING

A. Paper copies of the IOM shall also be shipped with each RTU.

B. The RTU manufacturer shall identify all shipments with the order number. Enough information shall be provided with each shipment to enable the Mechanical Contractor to confirm the receipt of units when they are received. For parts too small to mark individually, the RTU manufacturer shall place them in containers.

C. To protect equipment during shipment and delivery, all indoor units shall be completely stretch or shrink wrapped. Wrap shall be a minimum of 7 mil plastic. Pipe ends and pipe connection holes in the casing shall be capped or plugged prior to shipment

D. After loading the equipment for shipment, the RTU manufacturer shall contact the shipping contact on the order and provide the name of the carrier, description of equipment, order number, shipping point, and date of shipment.

3.2 ON-SITE STORAGE

A. If equipment is to be stored for a period of time prior to installation, the Mechanical Contractor shall remove all stretch or shrink wrap from units upon receipt to prevent unit corrosion and shall either place the units in a controlled indoor environment or shall cover the units with canvas tarps and place them in a well-drained area. Covering units with plastic tarps shall not be acceptable.

3.3 FIELD EXAMINATION

A. The Mechanical Contractor shall verify that the mechanical room and/or roof are ready to receive work and the opening dimensions are as indicated on the shop drawings and contract documents.

B. The Mechanical Contractor shall verify that the proper power supply is available prior to starting of the fans.

3.4 INSTALLATION

A. The Mechanical Contractor shall be responsible to coordinate ALL of his installation requirements with the Owner and the Owner's selected Mechanical Contractor to ensure that a complete installation for each unit is being provided. Coordination efforts shall include such items as unloading and hoisting requirements, field wiring requirements, field piping requirements, field ductwork requirements, requirements for assembly of field-bolted or welded joints, and all other installation and assembly requirements.

B. The Mechanical Contractor shall verify that the following items have been completed prior to scheduling the RTU manufacturer's final inspection and start up:

1. All spring-isolated components have had their shipping restraints removed and the components have been leveled.

2. On all field-joined units, that all interconnections have been completed, i.e., electrical and control wiring, piping, casing joints, bolting, welding, etc.
3. All water and steam piping connections have been completed and hydrostatically tested and all water flow rates have been set in accordance with the capacities scheduled on the Drawings.
4. All ductwork connections have been completed and all ductwork has been pressure tested for its intended service.
5. All power wiring, including motor starters and disconnects, serving the unit has been completed.
6. All automatic temperature and safety controls have been completed.

7. All dampers are fully operational.
8. All shipping materials have been removed.
9. All (clean) filter media has been installed in the units.

3.5 LEVELING

A. The Mechanical Contractor shall level all unit sections in accordance with the unit manufacturer's instructions. The Mechanical Contractor shall provide and install all necessary permanent shim material to ensure individual sections and entire assembled units are level.

3.6 FINAL INSPECTION AND START UP SERVICE

A. After the Mechanical Contractor has provided all water and steam piping connections, ductwork connections, and field control wiring, and Electrical Contractor has provided all the field power wiring, the Mechanical Contractor shall inspect the installation. The Mechanical Contractor shall then perform startup of the equipment.

B. The Automatic Temperature Control (Building Direct Digital Control) Contractor shall be scheduled to be at the job site at the time of the equipment start up.

C. The Mechanical Contractor, shall perform the following tests and services and submit a report outlining the results:

1. Record date, time, and person(s) performing service.
2. Lubricate all moving parts.
3. Check all motor and starter power lugs and tighten as required.
4. Verify all electrical power connections.
5. Conduct a start up inspection per the RTU manufacturer's recommendations.
6. Record fan motor voltage and amperage readings.
7. Check fan rotation and spin wheel to verify that rotation is free and does not rub or bind.
8. Check fan for excessive vibration.
9. Check V belt drive or coupling for proper alignment.
10. Check V belt drive for proper tension. Tighten the belts in accordance with the RTU manufacturer's directions. Check belt tension during the second and seventh day's operation and re-adjust belts, as may be required, to maintain proper tension as directed by the RTU manufacturer.
11. Remove all foreign loose material in ductwork leading to and from the fan and in the fan itself.
12. Disengage all shipping fasteners on vibration isolation equipment.
13. Check safety guards to insure they are properly secured.
14. Secure all access doors to the fan, the unit and the ductwork.
15. Switch electrical supply "on" and allow fan to reach full speed.
16. Physically check each fan at start up and shut down to insure no abnormal or problem conditions exist.
17. Check entering and leaving air temperatures (dry bulb and wet bulb) and simultaneously record

entering and leaving chilled water temperatures and flow, steam pressures and flow, and outside air temperature.

18. Check all control sequences.

D. The unit manufacturer shall train the Owner's Facility team for a minimum of one eight hour day and up to a maximum of two eight hour days (at the Owner's request and the manufacturer's expense) on the equipment specified herein.

END OF SECTION 23.7416

SECTION 23.8101 - TERMINAL HEAT TRANSFER UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Convectors.

B. Unit heaters.

C. Cabinet unit heaters.

D. Infrared Tube Heaters.

E. Electric Baseboard Radiation.

1.2 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.3 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

1.4 EXTRA MATERIALS

A. Provide two sets of filters for each piece of equipment requiring filters.

PART 2 - PRODUCTS

2.1 GENERAL

A. The contractor shall furnish and install all equipment with required mounting components and accessories to meet size, capacity and characteristics as required on the Equipment Schedule or on the plans. Units shall be installed in accordance with specifications and manufacturer recommendations.

2.2 CONVECTORS

A. Manufacturers:

1. Rittling.
2. Trane.
3. Sterling Hydronics.
4. Sigma.

B. Heating Elements: The coil shall be non-ferrous ½" nominal copper tubing and aluminum fins which are die cut with a thickness of no less than .010". The fins shall have integral collars and the tubes shall be mechanically bonded to the fins to ensure permanent contact. The entire fin assembly shall be encased in a heavy gauge galvanized steel frame with spacers locked at regular intervals to provide added protection to the finned element. Headers are cast brass with ¾" FNPT tapings. Assembled heating elements shall be hydrostatically tested to 1700 PSI prior to leaving the factory.

C. Cabinet: Enclosures shall be of the size and style as shown on the plans. The cabinet fronts shall be manufactured from 14-gauge cold rolled steel. Cabinet front shall be flanged on top and sides for added rigidity. The cabinet shall be reinforced and braced where necessary to provide additional stiffness. The liners shall be manufactured from 18-gauge cold rolled steel. The heating element support brackets shall be spot welded to the inside ends of the liners. Cabinet fronts are to be attached to liners using Tamper proof Spanner head fasteners.

D. Finish: All enclosures and accessories shall be degreased and chemically phosphatized before application of a durable, attractive electrostatic epoxy powder coating. Color to be selected from manufacturer's standard color chart.

E. Accessories:

1. For otherwise inaccessible valves, provide access doors that are to be flush mounted with doors hinged at the top and use a slotted fastener.

2.3 UNIT HEATERS

A. Manufacturers:

1. Rittling.
2. Trane.
3. Sterling Hydronics.
4. Sigma.

B. Cabinet: All units shall have panels fabricated of not less than 18 gauge cold rolled steel.

1. Horizontal Units:
   a. Casing consists of top/back and side halves. Both halves are joined on top and back with hex head screws.
   b. Top casing is furnished with threaded hanger connections for suspension of unit.

c. Fan venturi is die-formed on back half.
d. Units shall be equipped with horizontal, individually adjustable louvers.

C. Cabinet Finish: All painted cabinet exterior panels shall be finished with a standard textured gray epoxy powder coat paint.

D. Hot-Water Coil: Designed for either two-pipe steam or hot water heating system.

1. Coils shall have ½" nominal diameter seamless copper tubes and shall be mechanically expanded to provide an efficient, permanent bond between the tube and integral collar of the aluminum fin.
2. Minimum copper tube thickness shall be 0.028".
3. Fins shall be die-formed and have a high efficiency aluminum surface optimized for heat transfer, air pressure drop and carryover.
4. Minimum fin thickness shall be 0.010".
5. Lanced fins shall not be acceptable.
6. Fins are continuous across width and depth of coil and are vertically oriented to resist collection of dirt and foreign particles.
7. Coils shall be of non-ferrous construction with a serpentine design or incorporate brazed steel header tubes.
8. All coils shall be tested at 275 PSIG air pressure under water, and rated for a maximum 220 PSIG water or 150 PSIG steam and 375°F.

E. Fan: Propeller type with non-conducting, spark-proof aluminum blade wheel with steel hub directly mounted on motor shaft in the fan venturi.

F. Fan Guard: Shall be finger-proof, constructed of welded steel rod and finished with a standard black epoxy powder coat paint. Units mounted below 8 feet from the floor must be equipped with an OSHA fan guard to meet ETL and OSHA requirements.

G. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Motor Type: Permanently lubricated, two-speed, permanent split capacitor, totally enclosed with automatic reset integral thermal overload protection (3-phase motors require field supplied motor overload protection), designed to handle up to 104°F maximum constant ambient temperature. Shaded pole motors are not acceptable. Single speed motors are not acceptable.

H. Electrical Connection: Factory wire motors and controls for a single electrical connection.

1. Provide a service disconnect switch to isolate power from the unit during maintenance.

2.4 CABINET UNIT HEATERS

A. Manufacturers:

1. Rittling.

2. Trane.
3. Sterling Hydronics.
4. Sigma.

B. Cabinet: 16 gauge steel with baked epoxy powder coating in manufacturer's standard paint color as selected by Architect.

1. Vertical Units:

   a. Removable front panel, 16 gauge steel, with discharge grille, channel-formed edges and ¼-turn tamper-proof allen-head cam fasteners.
   b. Louvered panel shall be supplied with two flush, hinged access doors with slotted cam-lock fasteners.

2. Horizontal Units:
   a. The front panel shall be hinged, 16 gauge steel providing full swing through 90° including removable safety chain(s) to prevent the panel from swinging fully open accidentally. Includes discharge grille, channel-formed edges and ¼-turn allen-head cam fasteners.

3. End pockets shall be no less than 8” in width, located on both sides of the unit.
4. Steel recessing flanges for recessing fan-coil units into wall or ceiling.
5. All concealed units shall have a minimum 1" duct collar on the discharge.

C. Filters: Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

1. 1” Washable Aluminum Mesh: 70 percent arrestance and 2 MERV.

D. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.083 inch (2.1 mm), rated for a minimum working pressure of 300 psig (2067 kPa) and a maximum entering-water temperature of 220 deg F (104 deg C). Minimum copper tube thickness shall be 0.016”. Minimum fin thickness shall be 0.0045”. Lanced fins shall not be acceptable. Coils shall be circuited for counter flow to maximize unit efficiency. Coil casing shall be fabricated from galvanized steel. Include manual air vent and drain valve.

E. Fan and Motor Board: Constructed from 18 gauge galvannealed steel.

1. Fan: Forward curved, double width, centrifugal; directly connected to motor. galvanized-steel wheels and fan scrolls.

2. Motor: Electronically commutated high-efficiency, programmable brushless DC motor; resiliently mounted on motor board. Shaded pole motors are not acceptable. Single speed motors are not acceptable. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

F. Electrical Connection: Factory wire motors and controls for a single electrical connection.

1. Provide a service disconnect switch to isolate power from the unit during maintenance.

2.5 INFRARED TUBE HEATERS

A. Manufacturers:

1. Detroit Radiant Products Co.

B. Approvals:

1. CSA Design Certified

C. Burner Control Box:

1. Sight glass for burner inspection
2. Totally enclosed components
3. Serviceable while in operation
4. Coated enameled steel
5. Operational indicator lights

D. Gas Connection:

1. 7/8 in. flare-M FPT connection to 1/2 in. x 24 in. (304) SS flex connector provided

E. Gas Supply:

1. Manifold pressure: Inlet pressure: 5.0 to 14.0” W.C.

F. Power Supply:

1. 120 VAC, 60 Hz GRD, 1 Ph., 3-wire
2. 60 in. grounded power cord
3. Ignition current: 4.8 amps, Running current: 1.1 amps

G. Controls:

1. Two stage gas valve (at 100% and 65%)
2. Air proving safety switch
3. Silicon carbide hot surface ignition
4. Pre- & post-purge controls
5. Flame rod sensing
6. 24 V thermostatic control voltage
7. Self-diagnostic LED

H. Reflector:

1. Highly polished aluminum

2. Two end caps included
3. Reflector tension springs
4. Continuous overlap design
5. One reflector center support per reflector

I. Combustion & Radiant Tubes:

1. 16 ga. 4" O.D. aluminized coated steel radiant emitter tubes
2. Titanium coated combustion chamber (150–200 MBH models)
3. All tubes coated with high temperature, corrosion-resistant black coating, 0.95 emissivity
4. Slip-fit swaged tube connection
5. Turbulator baffle

J. Combustion Air Inlet & Venting:

1. Preset 4 in. combustion air inlet collar
2. Sidewall or roof venting

K. Limited Warranty:

1. 3 year–Burner box components
2. 5 years–Combustion and radiant tubes
3. 10 years–Burner

2.6 ELECTRIC BASEBOARD RADIAITON

A. Manufacturers:

1. Runtal.
2. Approved Equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install equipment exposed to finished areas after walls and ceiling are finished and painted. Do not damage equipment or finishes.

C. Protection: Provide finished cabinet units with protective covers during balance of construction.

D. Recessed Units: Install where indicated. Coordinate to assure correct recess size for recessed units.

E. Unit Heaters: Hang from building structure, with pipe hangers anchored to building, not from piping. Mount as high as possible to maintain greatest headroom unless otherwise indicated.

3.2 CLEANING

A. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

B. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

C. Install new filters.

END OF SECTION 23.8101

SECTION 23.8127 - SMALL SPLIT-SYSTEM HEATING AND COOLING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air cooled condensing units.

B. Indoor ductless fan & coil units.

C. Controls.

1.2 REFERENCE STANDARDS

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air Conditioning and Air-Source Heat Pump Equipment; Air-Conditioning, Heating, and Refrigeration Institute; 2008.

B. AHRI 520 - Performance Rating of Positive Displacement Condensing Units; Air-Conditioning, Heating, and Refrigeration Institute; 2004.

C. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2016 (ANSI/ASHRAE Std 15).

D. ASHRAE Std 23.1 - Methods of Testing for Rating Positive Displacement Refrigerant Compressors and Condensing Units that Operate at Subcritical Temperatures of the Refrigerant; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2010.

E. ASHRAE Std 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2016, Including All Addenda (ANSI/ASHRAE/IES Std 90.1).

F. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2011.

G. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association; 2018.

H. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems; National Fire Protection Association; 2018.

I. UL 207 - Refrigerant-Containing Components and Accessories, Nonelectrical; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

C. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.

D. Design Data: Indicate refrigerant pipe sizing.

E. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

F. Project Record Documents: Record actual locations of components and connections.

G. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

H. Warranty: Submit manufacturer’s warranty and ensure forms have been filled out in Owner’s name and registered with manufacturer.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of experience and approved by manufacturer.

1.5 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Mitsubishi.

B. LG.

C. Samsung.

D. Daikin.

E. Fujitsu.

F. Airstage.

2.2 SYSTEM DESIGN

A. Split-System Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.

1. Heating/Cooling: Outdoor electric condensing unit with evaporator in indoor ductless unit.
2. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.

2.3 INDOOR UNITS FOR DUCTLESS SYSTEMS

A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, evaporator coil, and controls; wired for single power connection with control transformer.

1. Fan: Line-flow fan direct driven by a single motor.

B. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.

1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
2. Manufacturer: System manufacturer.

2.4 OUTDOOR UNITS

A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.

1. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23.1 and UL 207.

B. Air Cooled Condenser: ARI 520; Aluminum fin and copper tube coil, with direct drive axial propeller fan resiliently mounted, galvanized fan guard.

C. Accessories: Filter drier, high pressure switch (manual reset), low pressure switch (automatic reset), service valves and gage ports, thermometer well (in liquid line).

D. Operating Controls:

1. Control by room thermostat to maintain room temperature setting.
2. Low Ambient Kit: Provide refrigerant pressure switch to cycle condenser fan on when condenser refrigerant pressure is above 285 psig and off when pressure drops below 140 psig for operation to 0 degrees F.
3. Provide wind baffle for low ambient cooling.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.

B. Verify that proper power supply is available and in correct location.

3.2 INSTALLATION

A. Install in accordance with NFPA 90A and NFPA 90B.

B. Install refrigeration systems in accordance with ASHRAE Std 15.

END OF SECTION 23.8127

SECTION 23.8313 – RADIANT HEATING CABLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Heating cable.

B. Temperature controllers for heating cable.

1.2 RELATED SECTIONS

A. Section 232113 - Hydronic Piping

B. Section 230719 - HVAC Piping Insulation.

C. Refer to the requirements of Division 1 and coordinate the division of responsibility of the work with Section 01 1000 – Summary of the Project.

1.3 PERFORMANCE REQUIREMENTS

A. Pipe Trace Heating: Freeze protection with outside temperature at -10 degrees F (-23 degrees C).

1.4 SUBMITTALS

A. See Section 01 3300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for heating cable and control components.

C. Shop Drawings: Indicate heating cable layout, locations of terminations, thermostats, and branch circuit connections.

D. Manufacturer's Installation Instructions: Indicate installation instructions.

E. Project Record Documents: Accurately record actual locations of heating cable and branch circuit connections.

F. Operation Data: Include description of operating controls.

G. Maintenance Data: Include repair methods and parts list of components.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.6 PRE-INSTALLATION MEETING

A. Convene one week prior to commencing work of this section.

B. Require attendance of parties directly affecting the work of this section.

C. Review sequencing of installation, protection from damage of finished installation, location of expansion and control joints in building, and methods used for covering installations with concrete.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Chromalox (SRL).

B. Orbit.

C. Nexans.

2.2 HEATING CABLE

A. Heating Cable: Self-limiting, parallel resistance heating cable.

2.3 ACCESSORIES

A. Thermostats:

1. Chromalox.
2. Orbit.
3. Nexans.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping is ready to receive work.

B. Verify field measurements are as shown on shop drawings.

C. Verify that required utilities are available, in proper location, and ready for use.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Avoid pinching and making sharp bends in cable.

C. Do not install heating cable across expansion or construction joints.

D. E.C. shall provide a service to the proximity of the cable locations. H.C. shall provide junction box and all interconnecting wiring between the E.C. service and the cables. H.C. shall be responsible for the final connection to the E.C. service.

3.3 FIELD QUALITY CONTROL

A. Test continuity of heating cable.

B. Perform tests on completed cable installation. For cables embedded in concrete, perform tests immediately before and after concrete placement.

C. Measure voltage and current at each unit.

3.4 DEMONSTRATION

A. Demonstrate operation of heating cable controls.

END OF SECTION 23.8313

SECTION 26.0100 - GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division-1 Specifications sections, apply to work specified in this section.

1.2 SCOPE OF PROJECT:

A. Provide a complete and operating electrical installation in accordance with these specifications and accompanying contract drawings. This includes all required labor, materials, apparatus and supervision.

B. Without limiting or restricting the volume of work and solely for the convenience of the Contractor, the work to be performed in general, comprises the following:

1. New Electric Distribution Facilities; Re-worked Medium Voltage Distribution.
2. New Building Electrical Distribution System.
3. New Building Lighting and Lighting Controls.
4. Complete Building Power System.
5. New Medium Voltage Transformers and New Associated Vaults and Ductbanks
5. New Outdoor Emergency Generators and Associated Transfer Switches and Temporary Connection Infrastructure.
6. New Structured Cabling to New and Existing Devices.
7. Expansion of Existing VoiP Telephone System.
8. Expansion of Existing IP Intercommunication System.
9. Expansion of Master Clock System.
10. Expansion of CCTV system.
11. Expansion of Security Detection and Alarm system.
12. Expansion of Access Control System
13. Expansion of Voice Based Fre Alarm System
14. Control wiring for Division 23 equipment where shown on Division 26 documents.

1.3 INTENT OF THIS SECTION:

A. This Section is intended as a supplement to each of the following Sections of Division 26, 27, 28 ELECTRICAL.

B. Consider each article of this Section as a part of each of the following Sections insofar as such requirements may be termed applicable.

1.4 TRUE INTENT:

A. The Drawings and Specifications are intended to provide a complete and perfectly operating system. Therefore, it is specifically agreed and understood by the Contractor that anything, be it labor, material or equipment, which is not described in the Specifications or specifically shown on the Drawings, but is necessary for the operation and completion of a perfectly operating system, according to the true intent of the Specifications and Drawings and as interpreted by the architect, shall be furnished by the Contractor as a part of his Contract, at no extra charge, as though it were specifically detailed and described.

1.5 DEFINITIONS:

A. General - Basic Contract definitions are included in the Conditions of the Contract.

B. Indicated - The term indicated refers to graphic representations, notes, or schedules on the Drawings, or other Paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Terms such as shown, noted, scheduled, and specified are used to help the reader locate the reference. There is no limitation on location.

C. Directed - Terms such as directed, requested, authorized, selected, approved, required, and permitted mean directed by the Architect, requested by the Architect, and similar phrases.

D. Approved - The term approved, when used in conjunction with the Architect's action on the Contractor's submittals, applications and requests, is limited to the Architects duties and responsibilities as stated in the Conditions of the Contract.

E. Regulation - The term regulation includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

F. Furnish - The term furnish means supply and deliver to the Project Site, ready for unloading, unpacking, assembly, installation and similar operations.

G. Install - The term install describes operations at the Project site including the actual unloading, unpacking, assembly, erection, placing anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. Provide - The term provide means to furnish and install, complete and ready for the intended use.

I. Contractor - The Contractor or Electrical Contractor - The term means the Contractor responsible for all work under this section.

J. Installer - An installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.

1. The term experienced, when used with the term installer, means having a minimum of five previous projects similar in size and scope to this project, being familiar with the special requirements indicated, and having complied with requirements of the authority having jurisdiction.
2. Trades - Using terms such as carpentry is not intended to imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as carpenter. It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.
3. Assigning Specialists - Certain Section of the Specifications require that specific construction activities are performed by specialists who are recognized experts in those operations. The specialists must be engaged for those activities, and their assignments are requirements over which the Contractor has no choice or option. However, the ultimate responsibility for fulfilling Contract requirements remains with the Contractor.
    a. This requirement is not to be interpreted to conflict with enforcing building codes and similar regulations governing the Work. It is also not intended to interfere with local trade union jurisdictional settlements and similar conventions.

K. Testing Agencies - A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere and to report on and, if required, to interpret results of those inspections or tests.

1.6 VISITS TO SITE:

A. Attention is directed to the necessity for all the Electrical Contractor to visit the site and examine all conditions affecting the proper execution of this Contract. Submission of proposals shall be considered evidence that Contractors have visited and examined the site.

B. Existing contours and topography as indicated, are believed to be reasonably correct, but are not guaranteed. Where conditions at project site do not agree exactly with conditions as indicated, Contractor shall assume all responsibility for said discrepancy.

C. No extra payment will be allowed the Electrical Contractor for extra work caused by failure to visit, examine and clarify.

1.7 GENERAL:

A. Throughout the Specifications, types of material are specified by manufacturer's name. Where more than one manufacturer is mentioned, catalog and specification data is given for a specific manufacturer. Equal material produced by other manufacturers listed is acceptable. Refer to SPECIAL REQUIREMENTS - Division 1 for substitution of materials.

1.8 RULES AND REGULATIONS

A. Perform in accordance with the rules and regulations of the National Electric Code (NEC), International Building Code (IBC) and other Codes and Standards cited in this specification and the requirements of the Utility Companies serving this project.

B. Certificates of Approval in triplicate, for rough and finished wiring from a Certified Inspection Service must be delivered to the Engineer before final payment can be authorized.

C. Perform all work in accordance with the rules and regulations of the Pennsylvania Department of Labor and Industry, Federal Department of Labor (Occupational Safety and Health Administration) and any other national, state, or local authority having jurisdiction.

D. Perform all Construction, design, fabrication, tests, rating, and installation in compliance with the regulations of all local, state or national agencies having jurisdiction over the project. Pay all costs involved in work necessary to comply with these regulations.

E. The Contractor assumes all responsibility and liability for any code violations, damage or injury which occurs as a result of deviation from or a change to the requirements of these plans and specifications which has not been approved in writing by the Engineer.

1.9 SUBMITTAL OF SHOP DRAWINGS FOR REVIEW:

A. Submit Shop Drawings in accordance with SUBMITTALS Division 1 and as indicated in subsequent Sections of this Division. Assume responsibility for quantities and correct mounting details. In addition, submit other shop drawings as may be requested by the Architect.

1. Metal Clad Cable
2. Building Wire
3. Medium Voltage Cables
4. Conduit
5. Fittings
6. Wireways
7. Outlet Boxes
8. Switches
9. Receptacles

10. Dry-Type Energy-Efficient Transformers
11. Switchboards
12. Electronic Circuit Monitors
13. Panelboards and Circuit Breakers
14. Safety Switches and Fuses
15. Fire Alarm & Detection System Equipment
16. Intrusion System Equipment.
17. Surveillance System Equipment.
18. Access Control System Equipment.
19. Area of Rescue Assistance Equipment (shown on drawings)
20. Structured Cabling system.
21. Emergency Generator & ATS
22. Interior and Exterior Lighting
23. Lighting Controls
24. PA and Master Clock System.
25 Selective Coordination and Arc-Flash Study.
26. Local Sound Reinforcement Systems.
27. Medium Voltage Transformers

1.10 DRAWINGS:

A. The Electrical drawings are indicative of the general arrangements and approximate sizes and relative locations of principal materials to be provided. Drawings are diagrammatic and are a graphic representation of contract requirements to best available standards at the scale required. Provide certain items such as pull boxes, offsets to clear interferences, and supports which are not specifically shown but which are obviously needed to make the system complete and operable.

B. Verify all grades, elevations, dimensions and clearances at the site.

C. Electrical riser and schematic diagrams generally indicate wiring to be used in various systems. Provide all work shown on diagrams whether or not it is duplicated on the plans.

D. All drawings and specifications pertaining to general construction, plumbing, HVAC, kitchen, electrical and other work shall be carefully examined. Where physical interferences with his work occur because of his failure to coordinate with other trades, this Contractor shall rearrange his work at his own expense.

1.11 ENVIRONMENTAL CONDITIONS:

A. Provide effective protection for all material and equipment against damage that may be caused by environmental conditions. Do no work when conditions or temperature in area or moisture on materials or substrates are not in accordance with material manufacturer's recommended conditions for installation.

1.12 PROTECTION:

A. Provide effective protection against damage for all materials and equipment during shipment, and storage at the Project site. Cover all stored equipment to exclude dust and moisture. Place stored conduit on dunnage with appropriate weather cover and caps on exposed ends.

B. After cabinets and boxes are installed, cover openings to prevent entrance of water and foreign materials. Close conduit openings with temporary metal or plastic caps, including those terminated in cabinets.

C. Protect all rough and finished floors and finished surfaces from damage which may be caused by construction materials and methods. Protect floors with tarpaulins, chip pans and oil-proof floor coverings. Protect finished surfaces from welding and cutting splatters with baffles and asbestos splatter blankets. Protect finished surfaces from paint droppings, adhesive and other marring agents with drop cloths. Protect other surfaces with appropriate protective measures.

1.13 PRODUCT:

A. Have materials delivered to site. Unload and store materials in allotted location, and protect from damage. Deliver materials to their point of installation.

B. Deliver materials to Project site in manufacturer's original unopened containers with manufacturer's name and product identification clearly marked thereon.

1.14 COMPLIANCE WITH GENERAL STANDARDS AND REGULATIONS:

A. Provide equipment that is in conformity with these specifications and applicable requirements of the following:

1. AASHTO American Assoc. of State Highway and Transportation Officials
2. ACI American Concrete Institute
3. AISC American Institute of Steel Construction
4. AISI American Iron and Steel Institute
5. ANSI American National Standards Institute
6. ASTM American Society for Testing and Materials
7. AWS American Welding Society
8. CBM Certified Ballast Manufacturers Assoc.
9. CRSI Concrete Reinforcing Steel Institute
10. EIA Electronic Industries Assoc.
11. ETL ETL Testing Laboratories Inc.
12. FM Factory Mutual Research Assoc.
13. ICEA Insulated Cable Engineers Association, Inc.
14. IEC International Electrotechnical Commission

15.	IEEE	Institute of Electrical and Electronic Engineers
16.	IESNA	Illuminating Engineering Society of North America
17.	IMSA	International Municipal Signal Association
18.	LPI	Lighting Protection Institute
19.	NEC	National Electric Code
20.	NECA	National Electrical Contractors Association
21.	NEMA	National Electrical Manufacturers Association
22.	NETA	International Electrical Testing Association
23.	NFPA	National Fire Protection Association
24.	UL	Underwriters Laboratories, Inc

1.15 COMPLIANCE WITH FEDERAL GOVERNMENT AGENCIES

A. Names and titles of federal government standard - or Specification-producing agencies are often abbreviated. The following acronyms or abbreviations referenced in the Contract Documents indicate names of standard - Specification-producing agencies of the federal government. Names and addresses are subject to change but are believed to be, but are not assured to be, accurate and up to the date of the Contract Documents.

1.	ADA	Americans with Disabilities Act
2.	CFR	Code of Federal Regulations
3.	EPA	Environmental Protection Agency
4.	FAA	Federal Aviation Administration (US Dept. of Transportation)
5.	FCC	Federal Communication Commission
6.	FS	Federal Specification (from GSA); Specifications Unit (WFISIS)
7.	MIL	Military Standardization Documents (US Department of Defense) Naval Publications and Forms Center
8.	OSHA	Occupational Safety and Health Administration (US Department of Labor)
9.	REA	Rural Electrification Administration (US Department of Agriculture)

1.16 GUARANTEE:

A. Each Contractor shall unconditionally guarantee in writing all materials, equipment, and workmanship for a period of one year from the date of substantial completion of the project. The Contractor shall provide free service for all equipment involved in his Contract during this guarantee period.

B. The guarantee shall include restoration to its original condition of all adjacent work that must be disturbed in fulfilling this guarantee.

C. All such repairs and/or replacements shall be made without delay and at the convenience of the Owner.

PART 2 - PRODUCTS

2.1 Refer to Division 26 - ELECTRICAL

PART 3 - EXECUTION

3.1 LOCATION OF MATERIAL:

A. Locate all lighting fixtures, power apparatus, conduit, outlets and other materials to result in proper operation of the building and to avoid conflicts with the work of other trades. Obtain required location information sufficiently in advance of installation time to allow uninterrupted progress of the work. Check layouts of equipment with shop drawings of all trades to determine roughing-in requirements. Do not scale drawings for exact locations. Exercise proper judgment to secure a neat arrangement of conduit, piping, ductwork and other material; and to overcome local interferences to best advantage of the Project.

B. Where physical interferences cannot be resolved readily, consult with the Construction Manager and Architect and prepare dated, dimensioned drawings correcting the interferences. Obtain written approval of the Construction Manager and Architect for such changes and distribute the drawings to all interested parties as directed by the Construction Manager and Architect.

C. In modular panel ceilings, locate lights, detectors and similar equipment as shown on reflected ceiling plan. Arrange ceiling outlets symmetrically. Verify locations of all floor outlets with Architect before roughing-in.

D. Locate switches and other manually operated devices in a location easily accessible and convenient to operating personnel. If any such devices are mounted in a location deemed inaccessible or impractical, relocate devices at no increase in contract costs.

3.2 EARTHWORK:

A. Provide all excavation, backfill, shoring and similar work as required for the installation of the Work of this Division. Refer to the requirements of Excavation, Grading and Site Work, Section 33, and Earthwork, Division 2.

B. Protect roots of live trees encountered in excavation.

C. Where excavations at footings, foundations, and other structures are deeper than the angle of repose deemed adequate by Architect, backfill such excavations solidly with 3000 pound concrete. All concrete must have air entrainment.

D. Remove and dispose of excess excavated materials as directed by the Construction Manager or Architect.

3.3 FLASHING AND COUNTERFLASHING:

A. Provide metal flashing and counterflashing under Division 26 in accordance with SHEET METAL, Division 7, for all conduits penetrating the roof. Form counterflashing into a rainhood attached to conduit and passed down over top of flashing. Attach counterflashing to conduit with clamp, and waterproof with sealing compound.

B. Base flashing will be worked into roofing.

3.4 CHASES AND OPENINGS:

A. Openings, recesses and chases will be provided in the building construction as described in SUPPLEMENTAL GENERAL CONDITIONS. Make detailed dimensioned drawings under Division 26 where required by Architect.

3.5 CUTTING AND PATCHING:

A. Perform all cutting of existing building construction under Division 26 as required for installation of electrical work.

B. Perform cutting carefully so as not to damage the structure or leave unsightly surfaces that cannot be covered with plates, escutcheons, or other normal concealing construction. Patch unsightly conditions resulting from cutting as directed by the Construction Manager or Architect. Engage competent mechanics for patching.

3.6 CONCRETE:

A. Provide all concrete required for the work of Division 26 - ELECTRICAL, unless otherwise noted. Provide 3000 pound concrete in accordance with the provisions of Division-CONCRETE.

B. Provide concrete housing cleaning pads for all freestanding electrical equipment inside and site light bases outside building, unless otherwise noted. Include all required anchor bolts, fish plates, sleeves, inserts, conduit and miscellaneous hardware and have them installed in their proper location in all concrete foundations.

3.7 MOTOR STARTERS

A. Furnish all manual motor starters, and mount where shown on drawings.

B. Mount manual motor starters for roof fans in an accessible location inside the building to avoid affecting thermal devices by atmospheric conditions.

C. In general, magnetic motor starters will be delivered to the site with the equipment they control.

1. Starters furnished under Division 21, 22, and 23 will be delivered to the Electrical Contractor for installation and wiring. The Electrical Contractor shall mount the starters where shown on the Drawings, and provide power wiring to the starter, as well as power wiring from the starter to the motor. Control wiring will be provided under the HVAC Contract.
2. Equipment furnished under other Divisions and under other contracts generally will not be combination type. Provide disconnects as required by the NEC within site of the controller and motor.
3. Check running current of each motor and verify correct size of overload elements, and fuses in combination starters. Notify Architect in writing of all overload elements and fuses incorrectly sized, so that corrective action can be initiated.
4. Prepare a typewritten list of all motors in the project, and submit to Architect for delivery to the Owner. Include the following information for each motor:
    a. Function and nomenclature, as identified by the marking actually used in the field.
    b. Physical location in the building.
    c. Rated horsepower, voltage and phase.
    d. Rated full load current.
    e. Proper size of thermal overload element.
    f. Mount all motor starters, except those factory mounted on equipment.

3.8 COLOR CODING OF WIRING

A. Color code all wiring in accordance with the following table. In general, use factory colored insulation. Use colored vinyl tape for black insulation on cables No. 8 and larger. Apply pressure sensitive tape in half-lap serving for distance of 6" at cable terminations, in pull boxes, manholes, panels, and similar locations.

1.	Phase	208/120 Volts	480/277 Volts
2.	Phase "A"	Black	Brown
3.	Phase "B"	Blue	Orange
4.	Phase "C"	Red	Yellow
5.	Neutral	White	Gray
6.	Equipment ground	Green	Green

3.9 PHASING

A. Phase building load centers and panelboards "A", "B", "C" top to bottom and left to right. Identify the neutral, although it may be in different locations for different equipment.

B. Connect transformers in all systems so that:

1. "A" Phase is terminated at "H1" connection.
2. "B" Phase is terminated at "H2" connection.
3. "C" Phase is terminated at "H3" connection.
4. "X1" connection shall be the "A" Phase.
5. "X2" connection shall be the "B" Phase.
6. "X3" connection shall be the "C" Phase.

C. Ascertain from Power Company phase identifications at the point of connection and thereafter carry out and maintain this consistent system of color coding, phase identification and positioning.

D. Verify phase rotation after all terminations at equipment have been made, by producing a 1-2-3 rotation on a phase sequence meter when connected to "A", "B", and "C" phases. Make phase rotation compatible with existing distribution system.

3.10 GROUNDING RESISTANCE TEST:

A. Provide grounding system resistance test to verify resistance. Maximum resistance shall be 5 ohms.

B. Send final certified test reports and Certifications to Construction Manager for approval and transmittal to the Owner in accordance with SUBMITTALS, Division 1.

3.11 INSPECTION AND CERTIFICATION:

A. Obtain and deliver a final Certificate of Approval from the applicable NEC inspection authority having jurisdiction. Make delivery to Construction Manager for transmittal to the Owner upon completion of the work and before final payment in accordance with PROJECT CLOSE-OUT, Division 1. Pay all charges made by the inspection authority and include their cost in the bid.

3.12 INSTALLATION:

A. Install equipment in accordance with manufacturer's recommendations.

3.13 EQUIPMENT BY OWNER:

A. The Owner will furnish certain equipment, and deliver this equipment to the site as stated in EQUIPMENT FURNISHED BY OWNER, Division 11. Provide final electrical connections as required.

3.14 AS-BUILT DRAWINGS:

A. During construction, the Contractor shall maintain a record set of installation prints. He shall record on these prints, all deviations from the Contract Drawings in pipe sizing, location, and details. The record set of installation prints shall be updated at the end of each month and shall be delivered to the Construction Manager and the Architect.

B. At the completion of the work, the Contractor shall forward these prints to the Construction Manager and the Architect for incorporation into the final As-Built Drawings.

3.15 INSTRUCTION TO EMPLOYEES:

A. At the completion of the work, and before final acceptance of the building by the Owner, each Contractor, together with the representatives of the manufacturers of the equipment installed by the Contractor, shall instruct the designated employees of the Owner in the care, adjustment, maintenance and operation of equipment installed by him. The instruction shall be video recorded and a copy of the recording turned over to the Owner for future reference.

B. Three copies of factory maintenance schedules shall be furnished for each of equipment. Acceptance of materials and equipment is conditional upon receipts of maintenance manuals.

C. A representative of the manufacturer of each piece of equipment shall inspect his respective pieces of equipment, make final adjustments, and put them in a satisfactory working condition.

D. Instructions described shall be given for the following systems:

1. Fire Alarm & Detection System.
2. Telephone System.
3. PA/Intercom and Master Clock System
4. Video Surveillance System.
5. Card Access System.
6. Security Detection and Alarm System.
7. Television Distribution System.
8. Theatrical Lighting Systems.
9. Local sound systems.
10. Media Distribution Network.
11. Lighting control systems.
12. A/V Systems

END OF SECTION 26.0100

SECTION 26.0513 - MEDIUM-VOLTAGE CABLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Medium voltage cable.

B. Cable accessories.

1.2 RELATED REQUIREMENTS

A. Section 26.0553 - Identification for Electrical Systems.

B. Section 33.7119 - Electrical Underground Ducts, Ductbanks, and Manholes: Cable racks in manholes.

1.3 REFERENCE STANDARDS

A. IEEE 48 - IEEE Standard for Test Procedures and Requirements for Alternating-Current Cable Terminations Used on Shielded Cables Having Laminated Insulation Rated 2.5 kV through 765 kV or Extruded Insulation Rated 2.5 kV through 500 kV; 2020.

B. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.

C. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 SUBMITTALS

A. See Section 01.3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide for cable, terminations, and accessories.

C. Sustainable Design Documentation: Submit manufacturer's product data on conductor and cable showing compliance with specified lead content requirements.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Project Record Documents: Record actual sizes and locations of cables.

F. Certificate of Compliance: Indicate approval of installation by authority having jurisdiction.

G. Maintenance Data: Include instructions for testing and cleaning cable and accessories.

1.5 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.

C. Installer Qualifications: Authorized installer of specified manufacturer with service facilities within 100 miles of Project.

D. Products: Listed, classified, and labeled as suitable for the purpose intended.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.1 MEDIUM-VOLTAGE CABLE

A. Manufacturers:

1. General Cable Technologies Corporation; _____: www.generalcable.com/#sle.
2. Okonite; _____: www.okonite.com/#sle.
3. Southwire Company; _____: www.southwire.com/#sle.
4. Substitutions: See Section 01.6000 - Product Requirements.

B. Medium Voltage Cable: NEMA WC 70 ethylene propylene insulated cable.

1. Voltage: 15 kV, grounded.
2. Conductor: Copper, concentric, stranded, with foil conductor shield.
3. Construction: Single conductor with metal wire insulation shielding.

2.2 CABLE ACCESSORIES

A. Potheads: IEEE 48, Class 1 termination. Pothead with porcelain insulators, cable connector and aerial lug, sealed cable entrance and support, and insulating compound.

B. Cable Terminations: IEEE 48, Class 2 porcelain insulator cable terminator in kit form.

C. Cast Epoxy Cable Terminations: IEEE 48, Class 1 cast epoxy cable termination in kit form with stress cone, shield ground connection, wet porcelain rain shield for outdoor units, epoxy resin molding material, and accessories and molds required for proper application.

D. Modular Cable Terminations: IEEE 48, Class 1, molded-rubber cable termination in kit form with stress cone, ground clamp, non-tracking rubber skirts, load break connector, rubber cap, and aerial lug.

E. Tape Terminations: IEEE 48; Class 1, tape termination kit with semi- conductive tape, stress control tape, splicing tape, vinyl plastic tape, stress cone, mechanical ground straps, and cable preparation kit.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that conduit, duct, trench, or manholes are ready to receive cable.

B. Verify that field measurements are as indicated.

C. Verify routing and termination locations of cable bank prior to rough-in.

D. Cable routing is shown in approximate locations unless dimensioned. Route as required to complete wiring system.

3.2 PREPARATION

A. Use swab to clean conduits before pulling cables.

3.3 INSTALLATION

A. Avoid abrasion and other damage to cables during installation.

B. Use suitable lubricants and pulling equipment.

C. Sustain cable pulling tensions and bending radii below recommended limits.

D. Ground cable shield at each termination and splice.

E. Install cables in manholes along wall providing longest route.

F. Arrange cable in manholes to avoid interference with duct entrances.

G. Fireproof cables in manholes using fireproofing tape in half-lapped wrapping. Extend fireproofing 1 inch into duct.

3.4 FIELD QUALITY CONTROL

A. See Section 01.4000 - Quality Requirements, for additional requirements.

B. Inspect exposed cable sections for physical damage.

C. Inspect cable for proper connections as indicated.

D. Inspect shield grounding, cable supports, and terminations for proper installation.

E. Inspect and test in accordance with NETA ATS, except Section 4.

F. Perform inspections and tests listed in NETA ATS, Section 7.3.3. The cable time domain reflectometer (TDR) measurements on each conductor listed as optional are not required.

3.5 PROTECTION

A. Protect installed cables from entrance of moisture.

END OF SECTION 26.0513

SECTION 26.0519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Single conductor building wire.

B. Underground feeder and branch-circuit cable.

C. Armored cable.

D. Metal-clad cable.

E. Variable-frequency drive cable.

F. Manufactured wiring systems.

G. Wiring connectors.

H. Electrical tape.

I. Heat shrink tubing.

J. Oxide inhibiting compound.

K. Wire pulling lubricant.

L. Cable ties.

M. Firestop sleeves.

1.2 RELATED REQUIREMENTS

A. Section 07.8400 - Firestopping.

B. Section 26.0513 - Medium-Voltage Cables: Cables and terminations for systems 601 V through 35,000 V.

C. Section 26.0526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

D. Section 26.0553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 28.4600 - Fire Detection and Alarm: Fire alarm system conductors and cables.

F. Section 31.2316 - Excavation.

G. Section 31.2316.13 - Trenching: Excavating, bedding, and backfilling.

H. Section 31.2323 - Fill: Bedding and backfilling.

1.3 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2024).

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2023.

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010, with Editorial Revision (2020).

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2020).

E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2024.

F. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2020.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

H. FM 3971 - Examination Standard for Fire Protective Coatings and Wraps for Grouped Cables; 2023.

I. IEEE 383 - IEEE Standard for Qualifying Electric Cables and Splices for Nuclear Facilities; 2023.

J. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

K. NECA 120 - Standard for Installing Armored Cable (AC) and Type Metal-Clad (MC) Cable; 2018.

L. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.

M. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

N. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

O. NFPA 79 - Electrical Standard for Industrial Machinery; 2024.

P. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

Q. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

R. UL 183 - Manufactured Wiring Systems; Current Edition, Including All Revisions.

S. UL 267 - Outline of Investigation for Wire-Pulling Compounds; Current Edition, Including All Revisions.

T. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

U. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

V. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

W. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

X. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

Y. UL 2277 - Outline of Investigation for Flexible Motor Supply Cable and Wind Turbine Tray Cable; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.

2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 01.3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

C. Sustainable Design Documentation: Submit manufacturer's product data on conductor and cable showing compliance with specified lead content requirements.

D. Manufactured Wiring System Shop Drawings: Provide plan views indicating proposed system layout with components identified; indicate branch circuit connections.

E. Wire Pulling Lubricant: Certification of compatibility with conductors/cables where used with the following insulation/jacket types:

1. Low-smoke zero halogen (LSZH).

F. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors. Include proposed modifications to raceways, boxes, wiring gutters, enclosures, etc. to accommodate substituted conductors.

G. Field Quality Control Test Reports.

H. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

I. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01.6000 - Product Requirements, for additional provisions.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

1. Exceptions:
    a. Use variable-frequency drive cable for connection between variable-frequency motor controllers and associated motors.

C. Nonmetallic-sheathed cable is not permitted.

D. Underground feeder and branch-circuit cable is not permitted.

E. Service entrance cable is not permitted.

F. Armored cable is not permitted.

G. Metal-clad cable is permitted only as follows:

1. Where not otherwise restricted, may be used:
    a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
        1) Maximum Length: 6 feet.
    b. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.
        1) Exception: Provide single conductor building wire in raceway for circuit homerun from first outlet to panelboard.
2. In addition to other applicable restrictions, may not be used:
    a. Unless approved by Owner.
    b. Where not approved for use by the authority having jurisdiction.
    c. Where exposed to damage.
    d. For damp, wet, or corrosive locations, unless provided with a PVC jacket listed as suitable for those locations.
    e. For isolated ground circuits, unless provided with an additional isolated/insulated grounding conductor.

H. Manufactured wiring systems are permitted only as follows:

1. Where not otherwise restricted, may be used:
    a. For branch circuits where concealed under raised floors, where concealed above accessible ceilings for lighting, and in open ceiling areas for lighting.
        1) Exception: Provide single conductor building wire in raceway for circuit homerun from distribution box to panelboard.
2. In addition to other applicable restrictions, may not be used:

a. Unless approved by Owner.
b. Where not approved for use by the authority having jurisdiction.
c. Where exposed to damage.
d. For damp, wet, or corrosive locations.
e. For isolated ground circuits, unless provided with an additional isolated/insulated grounding conductor.

2.2 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Provide new conductors and cables manufactured not more than one year prior to installation.

D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

E. Comply with NEMA WC 70.

F. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

G. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

H. Conductors for Grounding and Bonding: Also comply with Section 26.0526.

I. Conductor Material:

1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
3. Tinned Copper Conductors: Comply with ASTM B33.

J. Minimum Conductor Size:

1. Branch Circuits: 12 AWG.
   a. Exceptions:
      1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
      2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
2. Control Circuits: 14 AWG.

K. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

L. Conductor Color Coding:

1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
2. Color Coding Method: Integrally colored insulation.
   a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
3. Color Code:
   a. 208Y/120 V, 3 Phase, 4 Wire System:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.
4) Neutral/Grounded: White.

b. Equipment Ground, All Systems: Green.
c. Isolated Ground, All Systems: Green with yellow stripe.
d. Travelers for 3-Way and 4-Way Switching: Pink.
e. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.
f. For control circuits, comply with manufacturer's recommended color code.

2.3 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:

1. Copper Building Wire:
   a. Cerro Wire LLC: www.cerrowire.com/#sle.
   b. Encore Wire Corporation: www.encorewire.com/#sle.
   c. General Cable Technologies Corporation; _____: www.generalcable.com/#sle.
   d. Service Wire Co: www.servicewire.com/#sle.
   e. Southwire Company: www.southwire.com/#sle.
   f. Substitutions: See Section 01.6000 - Product Requirements.

B. Description: Single conductor insulated wire.

C. Conductor Stranding:

1. Feeders and Branch Circuits:
   a. Size 10 AWG and Smaller: Solid.
   b. Size 8 AWG and Larger: Stranded.
2. Control Circuits: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:

1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
   a. Size 4 AWG and Larger: Type XHHW-2.
   b. Installed Underground: Type XHHW-2.
   c. Fixture Wiring Within Luminaires: Type TFFN/TFN for luminaires with labeled maximum temperature of 90 degrees C; Approved suitable type for luminaires with labeled maximum temperature greater than 90 degrees C.

2.4 METAL-CLAD CABLE

A. Manufacturers:

1. AFC Cable Systems Inc: www.afcweb.com/#sle.
2. Encore Wire Corporation: www.encorewire.com/#sle.

3. Service Wire Co: www.servicewire.com/#sle.
4. Southwire Company: www.southwire.com/#sle.
5. Substitutions: See Section 01.6000 - Product Requirements.

B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:

1. Size 10 AWG and Smaller: Solid.
2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

F. Grounding: Full-size integral equipment grounding conductor.

1. Provide additional isolated/insulated grounding conductor where indicated.

G. Armor: Aluminum or steel, interlocked tape.

H. Provide PVC jacket applied over cable armor.

2.5 VARIABLE-FREQUENCY DRIVE CABLE

A. Manufacturers:

1. Service Wire Co; ServiceDrive: www.servicewire.com/#sle.
2. Substitutions: See Section 01.6000 - Product Requirements.

B. Description: Flexible motor supply cable listed and labeled as complying with UL 2277 in accordance with NFPA 79; specifically designed for use with variable frequency drives and associated nonlinear power distortions.

C. Conductor Stranding: Stranded.

D. Insulation Voltage Rating: 1000 V.

E. Insulation: Use only thermoset insulation types; thermoplastic insulation types are not permitted.

F. Grounding: Full-size integral equipment grounding conductor or symmetrical arrangement of multiple conductors of equivalent size.

G. Provide metallic shielding.

H. Jacket: PVC or Chlorinated Polyethylene (CPE).

2.6 MANUFACTURED WIRING SYSTEMS

A. Manufacturers:

1. AFC Cable Systems Inc: www.afcweb.com/#sle.
2. D&P Custom Lights & Wiring Systems, Inc: www.dandpcustomlights.com/#sle.
3. RELOC Wiring Solutions, a brand of Acuity Brands, Inc: www.relocwiring.com/#sle.
4. Wiremold, a brand of Legrand North America, Inc: www.legrand.us/#sle.
5. Substitutions: See Section 01.6000 - Product Requirements.

B. Description: Manufactured wiring assemblies complying with NFPA 70 Article 604, and listed and labeled as complying with UL 183.

C. Provide components necessary to transition between manufactured wiring system and other wiring methods.

D. Branch Circuit Cables:

1. Conductor Stranding (Size 10 AWG and Smaller): Solid.
2. Insulation Voltage Rating: 600 V.
3. Insulation: Type THHN.
4. Grounding: Full-size integral equipment grounding conductor.
   a. Provide additional isolated/insulated grounding conductor where indicated or required.
5. Armor: Steel, interlocked tape.

E. Connectors: Keyed and color-coded to prevent interconnection of different voltages.

F. Fixture Leads: Type TFN insulation.

2.7 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 26.0526.

C. Wiring Connectors for Splices and Taps:

1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.

D. Wiring Connectors for Terminations:

1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
6. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
7. Conductors for Control Circuits: Use crimped terminals for all connections.

E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

H. Mechanical Connectors: Provide bolted type.

I. Compression Connectors: Provide circumferential type crimp configuration.

J. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

2.8 ACCESSORIES

A. Electrical Tape:

1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
3. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
4. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.
5. Varnished Cambric Electrical Tape: Cotton cambric fabric tape, with or without adhesive, oil-primed and coated with high-grade insulating varnish; minimum thickness of 7 mil; suitable for continuous temperature environment up to 221 degrees F.
6. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.

C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.

D. Wire Pulling Lubricant:

1. Listed and labeled as complying with UL 267.
2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
3. Suitable for use at installation temperature.

E. Cable Ties: Material and tensile strength rating suitable for application.

F. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for cables and roofing system to be installed; designed to accommodate existing penetrations where applicable.

G. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

H. Fire-Protective Coating for Electrical Conductors and Cables: Field-applied, intumescent or ablative coating designed to prevent ignition and propagation of fire along thermoplastic-insulated conductors and cables.

1. Pass flammability tests of one of the following:
   a. ASTM E84, Class A; maximum flame spread index of 25.
   b. FM 3971.
   c. IEEE 383.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.3 INSTALLATION

A. Circuiting Requirements:

1. Unless dimensioned, circuit routing indicated is diagrammatic.
2. When circuit destination is indicated without specific routing, determine exact routing required.
3. Arrange circuiting to minimize splices.
4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is permitted, under the following conditions:
   a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
   b. Increase size of conductors as required to account for ampacity derating.
   c. Size raceways, boxes, etc. to accommodate conductors.
8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
9. Provide oversized neutral/grounded conductors where indicated and as specified below.
   a. Provide 200 percent rated neutral for feeders fed from K-rated transformers.
   b. Provide 200 percent rated neutral for feeders serving panelboards with 200 percent rated neutral bus.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install metal-clad cable (Type MC) in accordance with NECA 120.

E. Installation in Raceway:

1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.

2. Pull all conductors and cables together into raceway at same time.
3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

G. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

H. Terminate cables using suitable fittings.

1. Metal-Clad Cable (Type MC):
   a. Use listed fittings.
   b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
   c. Do not use direct-bearing set-screw type fittings for cables with aluminum armor.

I. Variable-Frequency Drive Cable: Terminate shielding at both variable-frequency motor controller and associated motor using glands or termination kits recommended by manufacturer.

J. Install conductors with a minimum of 12 inches of slack at each outlet.

K. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

L. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

M. Make wiring connections using specified wiring connectors.

1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
3. Do not remove conductor strands to facilitate insertion into connector.
4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

N. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.

1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
   a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.

b. For taped connections likely to require re-entering, including motor leads, first apply varnished cambric electrical tape, followed by adequate amount of rubber splicing electrical tape, followed by outer covering of vinyl insulating electrical tape.

2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
   a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
   b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
3. Wet Locations: Use heat shrink tubing.

O. Insulate ends of spare conductors using vinyl insulating electrical tape.

P. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

Q. Identify conductors and cables in accordance with Section 26.0553.

R. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07.8400.

S. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.4 FIELD QUALITY CONTROL

A. See Section 01.4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.

1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

D. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION 26.0519

SECTION 26.0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground bars.

E. Ground rod electrodes.

F. Ground enhancement material.

G. Ground access wells.

1.2 RELATED REQUIREMENTS

A. Section 13.4613 - Lightning Protection for Structures.

B. Section 26.0519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.

1. Includes oxide inhibiting compound.

C. Section 26.0553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26.5600 - Exterior Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.

1.3 REFERENCE STANDARDS

A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2025.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2022.

D. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. NFPA 99 - Health Care Facilities Code; 2027.

G. NFPA 780 - Standard for the Installation of Lightning Protection Systems; 2026.

H. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Verify exact locations of underground metal water service pipe entrances to building.
2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.5 SUBMITTALS

A. See Section 01.3000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

C. Shop Drawings:

1. Indicate proposed arrangement for signal reference grids. Include locations of items to be bonded and methods of connection.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Field quality control test reports.

F. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Installer Qualifications for Signal Reference Grids: Company with minimum five years documented experience with high frequency grounding systems.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 GROUNDING AND BONDING REQUIREMENTS

A. Do not use products for applications other than as permitted by NFPA 70 and product listing.

B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

D. Grounding System Resistance:

1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.

E. Grounding Electrode System:

1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
    a. Provide continuous grounding electrode conductors without splice or joint.
    b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
2. Metal Underground Water Pipe(s):
    a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
    b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
    c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
3. Metal In-Ground Support Structure:
    a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
4. Concrete-Encased Electrode:
    a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.

5. Ground Ring:
    a. Provide a ground ring encircling the building or structure consisting of bare copper conductor not less than 2 AWG in direct contact with earth, installed at a depth of not less than 30 inches.
    b. Where location is not indicated, locate ground ring conductor at least 24 inches outside building perimeter foundation.
    c. Provide ground enhancement material around conductor where indicated.

d. Provide connection from ground ring conductor to:
   1) Perimeter columns of metal building frame.
   2) Ground rod electrodes located at each corner of the building/structure.

6. Ground Rod Electrode(s):
   a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
   b. Space electrodes not less than 20 feet from each other and any other ground electrode.
   c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
   d. Provide ground enhancement material around electrode where indicated.
   e. Provide ground access well for each electrode.
7. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
8. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
   a. Ground Bar Size: 1/4 by 4 by 12 inches unless otherwise indicated or required.
   b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
   c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.
9. Ground Riser: Provide common grounding electrode conductor not less than 3/0 AWG for tap connections to multiple separately derived systems as permitted in NFPA 70.

F. Service-Supplied System Grounding:

1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.

G. Grounding for Separate Building or Structure Supplied by Feeder(s) or Branch Circuits:

1. Provide grounding electrode system for each separate building or structure.
2. Provide equipment grounding conductor routed with supply conductors.
3. For each disconnecting means, provide grounding electrode conductor to connect equipment ground bus to grounding electrode system.
4. Do not make any connections and remove any factory-installed jumpers between neutral (grounded) conductors and ground.

H. Separately Derived System Grounding:

1. Separately derived systems include, but are not limited to:
   a. Transformers (except autotransformers such as buck-boost transformers).
   b. Uninterruptible power supplies (UPS), when configured as separately derived systems.

c. Generators, when neutral is switched in the transfer switch.

2. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
4. Where common grounding electrode conductor ground riser is used for tap connections to multiple separately derived systems, provide bonding jumper to connect the metal building frame and metal water piping in the area served by the derived system to the common grounding electrode conductor.
5. Outdoor Source: Where the source of the separately derived system is located outside the building or structure supplied, provide connection to grounding electrode at source in accordance with NFPA 70.
6. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
7. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.

I. Bonding and Equipment Grounding:

1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
   a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
   b. Metal gas piping.
8. Provide bonding for interior metal air ducts.
9. Provide bonding for metal building frame.
10. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.
11. Provide bonding and equipment grounding for pools and fountains and associated equipment in accordance with NFPA 70.

12. Provide redundant grounding and bonding for patient care areas of health care facilities in accordance with NFPA 70 and NFPA 99.

J. Isolated Ground System:

1. Where isolated ground receptacles or other isolated ground connections are indicated, provide separate isolated/insulated equipment grounding conductors.
2. Connect isolated/insulated equipment grounding conductors only to separate isolated/insulated equipment ground busses.
3. Connect the isolated/insulated equipment grounding conductors to the solidly bonded equipment ground bus only at the service disconnect or separately derived system disconnect. Do not make any other connections between isolated ground system and normal equipment ground system on the load side of this connection.

K. Communications Systems Grounding and Bonding:

1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
   a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
   b. Raceway Size: 3/4 inch trade size unless otherwise indicated or required.
   c. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
   d. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

L. Lightning Protection Systems:

1. See Section 264100 for additional requirements.
2. Do not use grounding electrode dedicated for lightning protection system for component of building grounding electrode system provided under this section.
3. Provide bonding of building grounding electrode system provided under this section and lightning protection grounding electrode system in accordance with NFPA 70 and NFPA 780.

M. Pole-Mounted Luminaires: Also comply with Section 26.5600.

2.2 GROUNDING AND BONDING COMPONENTS

A. General Requirements:

1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26.0526:

1. Use insulated copper conductors unless otherwise indicated.
   a. Exceptions:
      1) Use bare copper conductors where installed underground in direct contact with earth.
      2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:

1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
    a. Exceptions:
        1) Use exothermic welded connections for connections to metal building frame.

D. Ground Bars:

1. Description: Copper rectangular ground bars with mounting brackets and insulators.
2. Size: 1/4"x4"x12" unless otherwise indicated or required.
3. Holes for Connections: As indicated or as required for connections to be made.
4. Manufacturers:
    a. allG Fabrication; _____: www.allgfab.com/#sle.
    b. Harger Lightning & Grounding; _____: www.harger.com/#sle.
    c. nVent ERICO; _____: www.nvent.com/#sle.
    d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC; _____: www.thermoweld.com/#sle.
    e. Substitutions: See Section 01.6000 - Product Requirements.

E. Ground Rod Electrodes:

1. Comply with NEMA GR 1.
2. Material: Copper-bonded (copper-clad) steel.
3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.
4. Where rod lengths of greater than 10 feet are indicated or otherwise required, sectionalized ground rods may be used.
5. Manufacturers:
    a. allG Fabrication; _____: www.allgfab.com/#sle.
    b. Galvan Industries, Inc; _____: www.galvanelectrical.com/#sle.
    c. Harger Lightning & Grounding; _____: www.harger.com/#sle.
    d. nVent ERICO; _____: www.nvent.com/#sle.
    e. Substitutions: See Section 01.6000 - Product Requirements.

F. Ground Enhancement Material:

1. Description: Factory-mixed conductive material designed for permanent and maintenance-free improvement of grounding effectiveness by lowering resistivity.

G. Ground Access Wells:

1. Description: Open bottom round or rectangular well with access cover for testing and inspection; suitable for the expected load at the installed location.
2. Size: As required to provide adequate access for testing and inspection, but not less than minimum size requirements specified.
    a. Round Wells: Not less than 8 inches in diameter.

b. Rectangular Wells: Not less than 12 by 12 inches.

3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 10 inches.
4. Cover: Factory-identified by permanent means with word "GROUND".

H. Oxide Inhibiting Compound: Comply with Section 26.0519.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.

1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.
2. Indoor Installations: Unless otherwise indicated, install with 4 inches of top of rod exposed.

D. Make grounding and bonding connections using specified connectors.

1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

E. Identify grounding and bonding system components in accordance with Section 26.0553.

3.3 FIELD QUALITY CONTROL

A. See Section 01.4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.13.

D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION 26.0526

SECTION 26.0529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.2 RELATED REQUIREMENTS

A. Section 03.3000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 05.5000 - Metal Fabrications: Materials and requirements for fabricated metal supports.

C. Section 26.0533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

D. Section 26.0533.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

E. Section 26.0548 - Vibration and Seismic Controls for Electrical Systems.

F. Section 26.5100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

G. Section 26.5600 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

1.3 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
2. Coordinate work to provide additional framing and materials required for installation.

3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has cured; see Section 03.3000.

1.5 SUBMITTALS

A. See Section 01.3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel/strut framing systems, nonpenetrating rooftop supports, and post-installed concrete/masonry anchors.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

D. Evaluation Reports: For products specified as requiring evaluation and recognition by ICC Evaluation Service, LLC (ICC-ES), provide current ICC-ES evaluation reports upon request.

E. Installer's qualification statement.

F. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 QUALITY ASSURANCE

A. Maintain at project site one copy of each referenced document that prescribes execution requirements.

B. Installer Qualifications for Powder-Actuated Fasteners: Certified by fastener system manufacturer with current operator's license.

C. Installer Qualifications for Field Welding: See Section 05.5000.

D. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

1. Comply with the following. Where requirements differ, comply with most stringent.
   a. NFPA 70.

b. Requirements of authorities having jurisdiction.

2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for load to be supported with minimum safety factor of _____. Include consideration for vibration, equipment operation, and shock loads where applicable.
5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
6. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
7. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
   a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
   b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
   c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
   d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Components for Vibration Isolation and/or Seismic Controls: See Section 26.0548.

C. Materials for Metal Fabricated Supports: See Section 05.5000.

D. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.

1. Manufacturers:
   a. ABB: www.electrification.us.abb.com/#sle.
   b. Atkore: www.atkore.com/#sle.
   c. Eaton Corporation: www.eaton.com/#sle.
   d. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
   e. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
   f. Substitutions: See Section 01.6000 - Product Requirements.
2. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
3. Conduit Clamps: Bolted type unless otherwise indicated.
4. Products:
   a. Atkore: www.atkore.com/#sle.
   b. Gripple, Inc; Universal Bracket: www.gripple.com/#sle.
   c. Gripple, Inc; Fast Trak: www.gripple.com/#sle.
   d. Gripple, Inc; Universal Clamp (Threaded): www.gripple.com/#sle.
   e. Gripple, Inc; Low Profile Bracket Kits: www.gripple.com/#sle.
   f. Substitutions: See Section 01.6000 - Product Requirements.

E. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.

1. Manufacturers:
   a. ABB: www.electrification.us.abb.com/#sle.

b. Eaton Corporation: www.eaton.com/#sle.
c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
d. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.

F. Metal Channel/Strut Framing Systems:

1. Manufacturers:
   a. ABB: www.electrification.us.abb.com/#sle.
   b. Atkore; Unistrut: www.atkore.com/#sle.
   c. Substitutions: See Section 01.6000 - Product Requirements.
   d. Source Limitations: Furnish channel/strut and associated fittings, accessories, and hardware produced by single manufacturer.
2. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
3. Comply with MFMA-4.
4. Channel/Strut Used as Raceway, Where Indicated: Listed and labeled as complying with UL 5B.
5. Channel Material:
   a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
   b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
6. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch.
7. Minimum Channel Dimensions: 1-5/8 inch wide by 13/16 inch high.

G. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.

1. Minimum Size, Unless Otherwise Indicated or Required:
   a. Equipment Supports: 1/2-inch diameter.
   b. Busway Supports: 1/2-inch diameter.
   c. Single Conduit up to 1-inch (27 mm) Trade Size: 1/4-inch diameter.
   d. Single Conduit Larger than 1-inch (27 mm) Trade Size: 3/8-inch diameter.
   e. Trapeze Support for Multiple Conduits: 3/8-inch diameter.
   f. Outlet Boxes: 1/4-inch diameter.
   g. Luminaires: 1/4-inch diameter.

H. Nonpenetrating Rooftop Supports for Low-Slope Roofs:

1. Manufacturers:
   a. Atkore; Unistrut: www.atkore.com/#sle.
   b. Eaton Corporation: www.eaton.com/#sle.
   c. Green Link, Inc: www.greenlinkengineering.com/#sle.
   d. PHP Systems/Design: www.phpsd.com/#sle.
   e. Substitutions: See Section 01.6000 - Product Requirements.
2. Description: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring attachment to roof structure and not penetrating roofing assembly, with support fixtures as specified.
3. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
4. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.

5. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.

I. Anchors and Fasteners:

1. Manufacturers - Mechanical Anchors:
   a. Atkore: www.atkore.com/#sle.
   b. Dewalt: anchors.dewalt.com/#sle.
   c. Hilti, Inc: www.hilti.com/#sle.
   d. ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com/#sle.
   e. MKT Fastening: www.mktfasteningusa.com/#sle.
   f. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.
   g. Substitutions: See Section 01.6000 - Product Requirements.
2. Manufacturers - Powder-Actuated Fastening Systems:
   a. Dewalt: anchors.dewalt.com/#sle.
   b. Hilti, Inc: www.hilti.com/#sle.
   c. ITW Ramset, a division of Illinois Tool Works, Inc: www.ramset.com/#sle.
   d. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.
   e. Substitutions: See Section 01.6000 - Product Requirements.
3. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
4. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
5. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
6. Hollow Masonry: Use toggle bolts.
7. Hollow Stud Walls: Use toggle bolts.
8. Steel: Use beam clamps, machine bolts, or welded threaded studs.
9. Sheet Metal: Use sheet metal screws.
10. Wood: Use wood screws.
11. Plastic and lead anchors are not permitted.
12. Powder-actuated fasteners are permitted only as follows:
    a. Where approved by Architect.
13. Hammer-driven anchors and fasteners are not permitted.
14. Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    a. Manufacturer: Same as manufacturer of metal channel/strut framing system.
    b. Comply with MFMA-4.
    c. Channel Material: Use galvanized steel.
    d. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch minimum base metal thickness.
15. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install hangers and supports in accordance with NECA 1.

C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

E. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

F. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

H. Provide required vibration isolation and/or seismic controls; see Section 26.0548.

I. Equipment Support and Attachment:

1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.
2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

J. Conduit Support and Attachment: See Section 26.0533.13 for additional requirements.

K. Box Support and Attachment: See Section 26.0533.16 for additional requirements.

L. Interior Luminaire Support and Attachment: See Section 26.5100 for additional requirements.

M. Exterior Luminaire Support and Attachment: See Section 26.5600 for additional requirements.

N. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

O. Secure fasteners in accordance with manufacturer's recommended torque settings.

P. Remove temporary supports.

Q. Identify independent electrical component support wires above accessible ceilings, where permitted, with color distinguishable from ceiling support wires in accordance with NFPA 70.

3.3 FIELD QUALITY CONTROL

A. See Section 01.4000 - Quality Requirements for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 26.0529

SECTION 26.0533.13 - CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Stainless steel rigid metal conduit (RMC).

C. Flexible metal conduit (FMC).

D. Liquidtight flexible metal conduit (LFMC).

E. Galvanized steel electrical metallic tubing (EMT).

F. Rigid polyvinyl chloride (PVC) conduit.

1.2 RELATED REQUIREMENTS

A. Section 03.3000 - Cast-in-Place Concrete: Concrete encasement of conduits.

B. Section 07.8400 - Firestopping.

C. Section 26.0526 - Grounding and Bonding for Electrical Systems.

1. Includes additional requirements for fittings for grounding and bonding.

D. Section 26.0529 - Hangers and Supports for Electrical Systems.

E. Section 26.0548 - Vibration and Seismic Controls for Electrical Systems.

F. Section 26.0553 - Identification for Electrical Systems: Identification products and requirements.

G. Section 26.2100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.

H. Section 31.2316.13 - Trenching: Excavating, bedding, and backfilling.

1.3 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2025.

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.

C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2025.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.

F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2025.

G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

H. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.

I. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.

J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

L. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

M. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel; Current Edition, Including All Revisions.

N. UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.

O. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

P. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

Q. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

R. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

S. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

T. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

1.5 SUBMITTALS

A. See Section 01.3000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

C. Shop Drawings:

1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.
2. Include proposed locations of roof penetrations and proposed methods for sealing.

1.6 QUALITY ASSURANCE

A. Documents at Project Site: Maintain at project site one copy of manufacturer's instructions and shop drawings.

B. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. See Section 01.7419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:

1. Under Slab on Grade: Use rigid PVC conduit.
2. Exterior, Direct-Buried: Use rigid PVC conduit.
3. Exterior, Embedded Within Concrete: Use rigid PVC conduit.
4. Where rigid polyvinyl chloride (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC) where emerging from underground.
5. Where rigid polyvinyl (PVC) conduit larger than 2-inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit (RMC) elbows for bends.
6. Where galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC) is installed in direct contact with earth where soil has resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection.
7. Where galvanized rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT) emerges from concrete into soil, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection for minimum of 4 inches on either side of where conduit emerges.

D. Embedded Within Concrete:

1. Within Slab on Grade: Not permitted.

2. Within Slab Above Ground: Not permitted.

E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit (RMC) or galvanized steel electrical metallic tubing (EMT).

F. Concealed Within Hollow Stud Walls: Use galvanized steel electrical metallic tubing (EMT).

G. Concealed Above Accessible Ceilings: Use galvanized steel electrical metallic tubing (EMT).

H. Interior, Damp or Wet Locations: Use galvanized steel electrical metallic tubing (EMT).

I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel electrical metallic tubing (EMT).

J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel electrical metallic tubing (EMT).

1. Locations subject to physical damage include, but are not limited to:
   a. Where exposed below 8 feet, except within electrical and communication rooms or closets.
   b. Where exposed below 20 feet in vehicle bays.

K. Exposed, Interior, Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC) .

1. Locations subject to severe physical damage include, but are not limited to:
   a. High traffic industrial and warehouse areas where exposed below 8 feet, except within electrical and communication rooms or closets.

L. Exposed, Exterior, Not Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC).

M. Exposed, Exterior, Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC) .

1. Exterior locations subject to severe physical damage include, but are not limited to:
   a. Where exposed to vehicular traffic below 20 feet.

N. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit (RMC).

O. Corrosive Locations Above Ground: Use stainless steel rigid metal conduit (RMC).

1. Corrosive locations include, but are not limited to:
   a. Cooling towers.
   b. Electroplating operations.
   c. Swimming pools and associated equipment areas.
   d. Wastewater treatment facilities.
   e. Marine environments.
   f. Chemical storage areas.

P. Flexible Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit (FMC).

1. Maximum Length: 6 feet.

Q. Flexible Connections to Vibrating Equipment:

1. Dry Locations: Use flexible metal conduit (FMC).

2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).
3. Maximum Length: 6 feet unless otherwise indicated.
4. Vibrating equipment includes, but is not limited to:
   a. Transformers.
   b. Motors.

2.2 CONDUIT - GENERAL REQUIREMENTS

A. Comply with NFPA 70.

B. Electrical Service Conduits: See Section 26.2100 for additional requirements.

C. Fittings for Grounding and Bonding: See Section 26.0526 for additional requirements.

D. Provide conduit, fittings, supports, and accessories required for complete raceway system.

E. Provide products listed, classified, and labeled as suitable for purpose intended.

F. Minimum Conduit Size, Unless Otherwise Indicated:

1. Branch Circuits: 3/4-inch trade size.
2. Branch Circuit Homeruns: 3/4-inch trade size.
3. Control Circuits: 1/2-inch trade size.
4. Flexible Connections to Luminaires: 3/8-inch trade size.
5. Underground, Interior: 3/4-inch trade size.
6. Underground, Exterior: 1-inch trade size.

G. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.3 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:

1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
2. Nucor Tubular Products: www.nucortubular.com/#sle.
3. Rymco USA: www.rymcousa.com/#sle.
4. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
5. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
6. Substitutions: See Section 01.6000 - Product Requirements.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:

1. Manufacturers:
   a. ABB; T&B: www.electrification.us.abb.com/#sle.
   b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.
   c. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
   d. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
   e. Substitutions: See Section 01.6000 - Product Requirements.
2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.

3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
4. Material: Use steel or malleable iron.
   a. Where not subject to severe corrosive influence, stainless steel or aluminum fittings may be used.
   b. Do not use die cast zinc fittings.
5. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.4 STAINLESS STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:

1. Atkore; Calbrite: www.atkore.com/#sle.
2. Gibson Stainless & Specialty Inc: www.gibsonstainless.com/#sle.
3. Patriot Industries, a division of Patriot Aluminum Products LLC: www.patriotsas.com/#sle.
4. Rymco USA: www.rymcousa.com/#sle.
5. Substitutions: See Section 01.6000 - Product Requirements.

B. Description: NFPA 70, Type RMC stainless steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6A.

1. Material: Type 304 or 316 stainless steel.

C. Fittings:

1. Manufacturers:
   a. Atkore; Calbrite: www.atkore.com/#sle.
   b. Eaton: www.eaton.com/#sle.
   c. Gibson Stainless & Specialty Inc: www.gibsonstainless.com/#sle.
   d. Patriot Industries, a division of Patriot Aluminum Products LLC: www.patriotsas.com/#sle.
   e. Substitutions: See Section 01.6000 - Product Requirements.
2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6A.
3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
4. Material: Use stainless steel with corrosion resistance equivalent to conduit.
5. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.5 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:

1. AFC Cable Systems, a division of Atkore International: www.afcweb.com/#sle.
2. Electri-Flex Company: www.electriflex.com/#sle.
3. International Metal Hose: www.metalhose.com/#sle.
4. Substitutions: See Section 01.6000 - Product Requirements.

B. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.

C. Fittings:

1. Manufacturers:
   a. ABB; T&B: www.electrification.us.abb.com/#sle.
   b. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
   c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
   d. Substitutions: See Section 01.6000 - Product Requirements.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
   a. Do not use die cast zinc fittings.

2.6 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:

1. AFC Cable Systems, a division of Atkore International: www.afcweb.com/#sle.
2. Electri-Flex Company: www.electriflex.com/#sle.
3. International Metal Hose: www.metalhose.com/#sle.
4. Substitutions: See Section 01.6000 - Product Requirements.

B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

C. Fittings:

1. Manufacturers:
   a. ABB; T&B: www.electrification.us.abb.com/#sle.
   b. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
   c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
   d. Substitutions: See Section 01.6000 - Product Requirements.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
   a. Do not use die cast zinc fittings.

2.7 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:

1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
2. Nucor Tubular Products: www.nucortubular/#sle.
3. Rymco USA: www.rymcousa.com/#sle.
4. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
5. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
6. Substitutions: See Section 01.6000 - Product Requirements.

B. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:

1. Manufacturers:

a. ABB; T&B: www.electrification.us.abb.com/#sle.
b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.
c. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
d. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
e. Substitutions: See Section 01.6000 - Product Requirements.

2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
   a. Do not use die cast zinc fittings.
4. Connectors and Couplings: Use compression/gland type.
   a. Do not use indenter type connectors and couplings.
5. Embedded Within Concrete, Where Permitted: Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are not acceptable.

2.8 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:

1. ABB; Carlon: www.carlon.com/#sle.
2. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
3. Cantex Inc: www.cantexinc.com/#sle.
4. Heritage Plastics, a division of Atkore International: www.heritageplastics.com/#sle.
5. JM Eagle: www.jmeagle.com/#sle.
6. Rymco USA: www.rymcousa.com/#sle.
7. Substitutions: See Section 01.6000 - Product Requirements.

B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

C. Fittings:

1. Manufacturer: Same as manufacturer of conduit to be connected.
2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.9 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch.

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.

C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

D. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf.

E. Foam Conduit Sealant:

1. Removable, two-part, closed-cell foam, specifically designed for sealing conduit openings against water, moisture, gases, and dust.
2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.

3. Rated to hold minimum of 10 ft water head pressure.

F. Conduit Mechanical Seals:

1. Listed as complying with UL 514B.
2. Specifically designed for sealing conduit openings against water, moisture, gases, and dust.
3. Suitable for sealing around installed conductors/cables.

G. Sealing Compound for Hazardous/Classified Location Sealing Fittings: Listed for use with particular fittings to be installed.

H. Sealing Systems for Concrete Penetrations:

1. Sleeves: Provide water stop ring or cement coating that bonds to concrete to prevent water infiltration.
2. Rate for minimum of 40 psig; suitable for sealing around conduits to be installed.

I. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

J. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for conduit/duct arrangement to be installed.

K. Bore Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for installation within casing; furnished with roller wheels to facilitate installation, openings to facilitate grout flow, and holes for stabilization cable; suitable for casing and conduit/duct arrangement to be installed.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install conduit in accordance with NECA 1.

C. Galvanized Steel Rigid Metal Conduit (RMC): Install in accordance with NECA 101.

D. Intermediate Metal Conduit (IMC): Install in accordance with NECA 101.

E. Rigid Polyvinyl Chloride (PVC) Conduit: Install in accordance with NECA 111.

F. Conduit Routing:

1. Unless dimensioned, conduit routing indicated is diagrammatic.
2. When conduit destination is indicated without specific routing, determine exact routing required.
3. Conceal conduits unless specifically indicated to be exposed.
4. Conduits in the following areas may be exposed, unless otherwise indicated:
   a. Electrical rooms.

b. Mechanical equipment rooms.
c. Within joists in areas with no ceiling.

5. Unless otherwise approved, do not route exposed conduits:
   a. Across floors.
   b. Across roofs.
   c. Across top of parapet walls.
   d. Across building exterior surfaces.
6. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
7. Arrange conduit to maintain adequate headroom, clearances, and access.
8. Arrange conduit to provide no more than equivalent of four 90-degree bends between pull points.
9. Arrange conduit to provide no more than 150 feet between pull points.
10. Route conduits above water and drain piping where possible.
11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
    a. Heaters.
    b. Hot water piping.
    c. Flues.
14. Group parallel conduits in same area on common rack.

G. Conduit Support:

1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 26.0529.
2. Provide required vibration isolation and/or seismic controls; see Section 26.0548.
3. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
4. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
5. Use conduit strap to support single surface-mounted conduit.
   a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
6. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.
7. Use conduit clamp to support single conduit from beam clamp or threaded rod.
8. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.
9. Use nonpenetrating rooftop supports to support conduits routed across rooftops, where approved.
10. Use of spring steel conduit clips for support of conduits is not permitted.
11. Use of wire for support of conduits is not permitted.

12. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with most stringent requirements.

H. Connections and Terminations:

1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
7. Secure joints and connections to provide mechanical strength and electrical continuity.

I. Penetrations:

1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
6. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
7. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 07.8400.

J. Underground Installation:

1. Provide trenching and backfilling; see Section 31.2316.13.

K. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):

1. Secure conduits to prevent floating or movement during pouring of concrete.

L. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide minimum concrete cover of 3 inches on all sides unless otherwise indicated; see Section 03.3000.

M. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:

1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.

3. Where conduits are subject to earth movement by settlement or frost.

N. Conduit Sealing:

1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
   a. Where conduits enter building from outside.
   b. Where service conduits enter building from underground distribution system.
   c. Where conduits enter building from underground.
   d. Where conduits may transport moisture to contact live parts.
2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
   a. Where conduits pass from outdoors into conditioned interior spaces.
   b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
   c. Where conduits penetrate coolers or freezers.
3. Where conduits cross boundaries of hazardous/classified locations, provide identified/listed sealing fittings or conduit mechanical seals as approved by authorities having jurisdiction; locate as indicated or in accordance with NFPA 70.

O. Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

P. Provide grounding and bonding; see Section 26.0526.

Q. Identify conduits; see Section 26.0553.

3.3 FIELD QUALITY CONTROL

A. See Section 01.4000 - Quality Requirements for additional requirements.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective conduits.

3.4 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.5 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION 26.0533.13

SECTION 26.0533.16 - BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

C. Boxes and enclosures for integrated power, data, and audio/video.

D. Floor boxes.

E. Underground boxes/enclosures.

F. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 03.3000 - Cast-in-Place Concrete.

B. Section 07.8400 - Firestopping.

C. Section 08.3100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.

D. Section 26.0526 - Grounding and Bonding for Electrical Systems.

E. Section 26.0529 - Hangers and Supports for Electrical Systems.

F. Section 26.0533.13 - Conduit for Electrical Systems:

1. Conduit bodies and other fittings.
2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

G. Section 26.0533.23 - Surface Raceways for Electrical Systems:

H. Section 26.0548 - Vibration and Seismic Controls for Electrical Systems.

I. Section 26.0553 - Identification for Electrical Systems: Identification products and requirements.

J. Section 26.2726 - Wiring Devices:

1. Wall plates.
2. Floor box service fittings.
3. Additional requirements for locating boxes for wiring devices.

K. Section 27.1000 - Structured Cabling: Additional requirements for communications systems outlet boxes.

L. Section 33.7119 - Electrical Underground Ducts, Ductbanks, and Manholes: Concrete manholes for electrical systems.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013 (Reaffirmed 2020).

F. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; 2013 (Reaffirmed 2020).

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. SCTE 77 - Specifications for Underground Enclosure Integrity; 2023.

I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

K. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

L. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

M. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 01.3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

1. Underground Boxes/Enclosures: Include reports for load testing in accordance with SCTE 77 certified by a professional engineer or an independent testing agency upon request.

C. Samples:

1. Floor Boxes: Provide one sample(s) of each floor box proposed for substitution upon request.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01.6000 - Product Requirements, for additional provisions.
2. Keys for Lockable Enclosures: Two of each different key.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.1 BOXES

A. General Requirements:

1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:

1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use cast iron boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
4. Use nonmetallic boxes where exposed rigid PVC conduit is used.
5. Use suitable concrete type boxes where flush-mounted in concrete.
6. Use suitable masonry type boxes where flush-mounted in masonry walls.
7. Use raised covers suitable for the type of wall construction and device configuration where required.

8. Use shallow boxes where required by the type of wall construction.
9. Do not use "through-wall" boxes designed for access from both sides of wall.
10. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
11. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
12. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
13. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
14. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
15. Minimum Box Size, Unless Otherwise Indicated:
    a. Wiring Devices: 4 inch square by 2-1/8 inch deep (100 by 54 mm) trade size.
    b. Communications Systems Outlets: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size.
16. Wall Plates: Comply with Section 26.2726.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:

1. Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA EN 10250 Environment Type, Unless Otherwise Indicated:
    a. Indoor Clean, Dry Locations: Type 1, painted steel.
    b. Outdoor Locations: Type 3R, painted steel.
3. Junction and Pull Boxes Larger Than 100 cubic inches:
    a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
    a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
    b. Back Panels: Painted steel, removable.
    c. Terminal Blocks: Provide voltage/current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity.
5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.

D. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gangable boxes may be used.

E. Floor Boxes:

1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 26.2726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
2. Manufacturer: Same as manufacturer of floor box service fittings.

F. Underground Boxes/Enclosures:

1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
2. Size: As indicated on drawings.

3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 24 inches.
4. Provide logo on cover to indicate type of service.
5. Applications:
   a. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.
6. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.
   a. Combination fiberglass/polymer concrete boxes/enclosures are acceptable.

2.2 ACCESSORIES

A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for boxes and facade materials to be installed.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

H. Box Locations:

1. Locate boxes to be accessible. Provide access panels in accordance with Section 08.3100 as required where approved by the Architect.
2. Unless dimensioned, box locations indicated are approximate.
3. Locate boxes as required for devices installed under other sections or by others.
   a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26.2726.
   b. Communications Systems Outlets: Comply with Section 271005.
4. Locate boxes so that wall plates do not span different building finishes.
5. Locate boxes so that wall plates do not cross masonry joints.

6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
    a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
    b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26.0533.13.
11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
    a. Concealed above accessible suspended ceilings.
    b. Within joists in areas with no ceiling.
    c. Electrical rooms.
    d. Mechanical equipment rooms.

I. Box Supports:

1. Secure and support boxes in accordance with NFPA 70 and Section 26.0529 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.

J. Install boxes plumb and level.

K. Flush-Mounted Boxes:

1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

L. Floor-Mounted Cabinets: Mount on properly sized 4 inch high concrete pad constructed in accordance with Section 03.3000.

M. Install boxes as required to preserve insulation integrity.

N. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

O. Nonmetallic Floor Boxes: Cut box flush with finished floor after concrete pour.

P. Underground Boxes/Enclosures:

1. Install enclosure on gravel base, minimum 6 inches deep.
2. Provide cast-in-place concrete collar constructed in accordance with Section 03.3000, minimum 10 inches wide by 12 inches deep, around enclosures that are not located in concrete areas.
3. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.

Q. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

R. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07.8400.

S. Close unused box openings.

T. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

U. Provide grounding and bonding in accordance with Section 26.0526.

V. Identify boxes in accordance with Section 26.0553.

3.3 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.4 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION 26.0533.16

SECTION 26.0536 - CABLE TRAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal cable tray systems:

1. Metal ladder cable tray.

1.2 RELATED REQUIREMENTS

A. Section 26.0513 - Medium-Voltage Cables.

B. Section 26.0519 - Low-Voltage Electrical Power Conductors and Cables.

C. Section 26.0526 - Grounding and Bonding for Electrical Systems.

D. Section 26.0529 - Hangers and Supports for Electrical Systems.

E. Section 26.0548 - Vibration and Seismic Controls for Electrical Systems.

F. Section 26.0553 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

B. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

D. NEMA BI 50015 - Metal Cable Tray Systems; 2024.

E. NEMA BI-50016 - Cable Tray Installation Guidelines; 2024.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate arrangement of cable tray with structural members, ductwork, piping, equipment and other potential conflicts. Coordinate work to avoid installation of obstructions within cable tray required clearances.
2. Coordinate arrangement of cable tray with dimensions and clearance requirements of actual products to be installed.
3. Coordinate work with placement of supports and anchors required for mounting.
4. Notify of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Preinstallation Meeting: Convene one week prior to commencing work of this section; require attendance of affected installers. Review proposed routing, sequence of installation, and protection requirements for installed cable tray.

C. Sequencing:

1. Do not begin installation of cables until installation of associated cable tray run is complete.

1.5 SUBMITTALS

A. See Section 01.3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cable tray system components and accessories. Include dimensions, materials, fabrication details, finishes, and span/load ratings.

C. Shop Drawings: Include dimensioned plan views and sections indicating proposed cable tray routing, required clearances, and locations and details of supports, fittings, building element penetrations, and equipment connections.

D. Derating Calculations for Fiberglass Cable Tray Systems: Indicate span/load ratings adjusted for applicable service conditions.

E. Manufacturer qualification statement.

F. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Project Record Documents: Record actual routing of cable tray and locations of supports.

1.6 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

C. Product Evaluation and Listing Organization Qualifications: Organization engaged in evaluation of products and services, including those recognized by OSHA as Nationally Recognized Testing Laboratories (NRTL), and acceptable to authorities having jurisdiction.

D. See Section 26.0513 for additional requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions and NEMA BI-50016, except do not store cable tray outdoors without cover as permitted in NEMA BI-50016.

B. Handle products carefully to avoid damage to finish.

PART 2 PRODUCTS

2.1 CABLE TRAY SYSTEM - GENERAL REQUIREMENTS

A. Provide new cable tray system consisting of required components, fittings, supports, and accessories, as necessary for complete system.

B. Provide products listed, classified, and labeled as suitable for purpose intended.

C. Do not use cable tray for applications other than as permitted by NFPA 70 and product listing/classification.

D. Provide cable tray system and associated components suitable for use at indicated span/load ratings under service conditions at installed location.

E. Unless otherwise indicated, specified span/load ratings are based on safety factor of 1.5 and working load only (i.e., no additional concentrated static load), with ratings for metal cable tray systems in accordance with NEMA BI 50015.

F. Unless otherwise indicated, specified load/fill depths and inside widths are nominal values, with values for metal cable tray systems in accordance with NEMA BI 50015 including applicable allowable tolerances.

2.2 METAL CABLE TRAY SYSTEMS

A. Manufacturers:

1. ABB, Inc: www.new.abb.com/#sle.
2. Atkore; Cope: www.atkore.com/#sle.
3. Cablofil, a brand of Legrand North America, Inc: www.legrand.us/cablofil/#sle.
4. Substitutions: See Section 01.6000 - Product Requirements.
5. Source Limitations: Furnish cable tray system and associated components and accessories produced by single manufacturer and obtained from single supplier.

B. Comply with NEMA BI 50015.

C. Material/Finishes:

1. Zinc Electroplated Steel: Comply with ASTM B633.
2. Mill-Galvanized Before Fabrication (Pre-Galvanized) Steel: Comply with ASTM A653/A653M, G90 coating.

D. Metal Ladder Cable Tray:

1. Material: Mill-galvanized before fabrication (pre-galvanized) steel.
2. Side Rail Construction: C-channel flange out.
3. Load/Fill Depth: 6 inches.
4. Span/Load Rating: NEMA VE 1 Class 10A.
5. Rung Spacing: 6 inches on center for straight lengths.
6. Inside Width: 18 inches.
7. Inside Radius of Fittings: 12 inches.
8. Covers: Solid flat nonflanged.

2.3 ACCESSORIES

A. Cable Tray Cover Clamps:

1. Provide heavy-duty wrap around style clamps.

B. Cable Clamps:

1. Material: Stainless steel.
2. Type: Trefoil.
3. Minimum Short Circuit Listed Rating: 65 kA.

2.4 SOURCE QUALITY CONTROL

A. See Section 01.4000 - Quality Requirements for additional requirements.

B. Metal Cable Tray: Perform factory design tests in accordance with NEMA BI 50015, including electrical continuity and load testing.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that work likely to damage cable tray system has been completed.

B. Verify field measurements.

C. Verify dimensions and span/load ratings of cable tray system components.

D. Verify that mounting surfaces are ready to receive cable tray and associated supports.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install cable tray in accordance with NECA 1 (general workmanship) and NEMA BI-50016.

C. Unless otherwise indicated, arrange cable tray to be parallel or perpendicular to building lines.

D. Arrange cable tray to provide required clearances and maintain cable access.

1. Minimum Clearance Above and Adjacent to Cable Tray: 12 inches.
2. Arrange cable tray systems to stack higher voltage circuits in cable trays above and lower voltage circuits in cable trays below.
3. Minimum Separation Distance from other Cable Trays and Building Components:
   a. Horizontal: Width of installed cable tray.
   b. Vertical: 2.5 times width of installed cable tray.

E. Install cable tray plumb and level, with sections aligned and with horizontal runs at specified elevation.

F. Cable Tray Movement Provisions:

1. Provide expansion fittings where cable tray is subject to movement, including but not limited to:
   a. Where cable tray crosses structural joints intended for expansion.
   b. Long straight cable tray runs in accordance with NEMA BI-50016.
2. Use expansion guides in lieu of hold-down clamps where prescribed in NEMA BI-50016.
3. Set gaps for expansion fittings in accordance with NEMA BI-50016.

G. Cable and Conductors:

1. Ampacity: As determined by applications listed in NFPA 70.

H. Cable Provisions:

1. Use fixed barrier strips to maintain separation of cables as indicated and as required by NFPA 70.

2. Use drop-out fittings or bushings where cables exit cable tray as required to maintain minimum cable bending radius.
3. Use cable support fittings for long vertical cable tray runs with heavy cables.

I. Provide end closures at unconnected ends of cable tray runs.

J. Cable Tray Support:

1. See Section 26.0529 for additional requirements.
2. See Section 26.0548 for vibration isolation and/or seismic controls.
3. Use manufacturer's recommended hangers and supports, located in accordance with NEMA BI-50016 and manufacturer's requirements, but not exceeding specified span unless otherwise approved by Engineer. Provide required support and attachment where not furnished by cable tray manufacturer.
4. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

K. Grounding and Bonding Requirements:

1. See Section 26.0526 for additional requirements.
2. Comply with grounding and bonding requirements of NEMA BI-50016.
3. Metal Cable Tray Systems: Use suitable bonding jumpers or classified cable tray connectors to provide electrical continuity. Do not use classified cable tray connectors where cable tray sections have been modified, such as being bent, cut, or reshaped.
4. Provide suitable equipment grounding conductor in each metal cable tray. Do not use metal cable tray system as sole equipment grounding conductor.
    a. Equipment Grounding Conductor for Galvanized Steel Cable Tray: Use bare or insulated copper conductor.
    b. Equipment Grounding Conductor for Aluminum Cable Tray: Use insulated copper conductor only; do not use bare copper conductor.
    c. Minimum Equipment Grounding Conductor Size: 6 AWG copper.
    d. Bond equipment grounding conductor to each metal cable tray section using suitable listed ground clamps. Separate bonding jumpers are not required where properly bonded equipment grounding conductor provides equivalent continuity.

L. Conduit Termination:

1. Use listed cable tray conduit clamps (evaluated for bonding connection) to terminate conduits at cable tray.
2. Provide insulating bushing at conduit termination to protect cables.
3. Provide independent support for conduit.

M. Cable Installation:

1. Install cables in accordance with cable installation requirements of NEMA BI-50016.
2. Use appropriate cable pulling tools, applied to prevent excessive force on cable tray system and maintain minimum cable bending radius.
3. Use cable clamps or cable ties to fasten conductors/cables to vertical and horizontal runs of cable tray
    a. Distance Between Fastening Points for Vertical Runs: 18 inches.

b. Distance Between Fastening Points for Horizontal Runs: As required to maintain spacing and confine conductor/cable within cable fill area.

N. Penetrations: Install firestopping to preserve fire resistance rating of building elements.

O. Identification Requirements:

P. Install cable tray covers where indicated and as follows:

3.3 FIELD QUALITY CONTROL

A. See Section 01.4000 - Quality Requirements for additional requirements.

B. Inspect cable tray system for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective cable tray system components.

3.4 ADJUSTING

A. Adjust tightness of mechanical connections to manufacturer's recommended torque settings.

3.5 CLEANING

A. Remove dirt and debris from cable tray.

B. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.6 PROTECTION

A. Protect cable tray system from subsequent construction operations.

END OF SECTION 26.0536

SECTION 26.0548 - VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Vibration isolation requirements.

B. Vibration-isolated equipment support bases.

C. Vibration isolators.

1.2 RELATED REQUIREMENTS

A. Section 01.4533 - Code-Required Special Inspections and Procedures.

B. Section 03.3000 - Cast-in-Place Concrete.

C. Section 26.0529 - Hangers and Supports for Electrical Systems.

1.3 DEFINITIONS

A. Electrical Component: Where referenced in this section in regards to seismic controls, applies to any portion of the electrical system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., conduit, cable tray).

1.4 REFERENCE STANDARDS

A. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
2. Coordinate the work with other trades to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03.3000.

1.6 SUBMITTALS

A. See Section 01.3000 - Administrative Requirements, for submittal procedures.

B. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.

1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.
2. Seismic Controls: Include seismic load capacities.

D. Shop Drawings - Vibration Isolation Systems:

1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.
2. Vibration-Isolated Equipment Support Bases: Include base weights, including concrete fill where applicable; indicate equipment mounting provisions.

E. Evaluation Reports: For products specified as requiring evaluation and recognition by a qualified evaluation service, provide current evaluation reports.

F. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Evidence of qualifications for seismic controls designer.

H. Evidence of qualifications for manufacturer.

I. Manufacturer’s detailed field testing and inspection procedures.

J. Field quality control test reports.

1.7 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

D. Seismic Controls Designer Qualifications: Registered professional engineer licensed in the State in which the Project is located and with minimum five years experience designing seismic restraints for nonstructural components.

1. Designer may be employed by the manufacturer of the seismic restraint products.

E. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 VIBRATION ISOLATION REQUIREMENTS

A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing electrical equipment and/or electrical connections to vibration-isolated equipment.

B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:

C. General Requirements:

1. Select vibration isolators to provide required static deflection.
2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
3. Select vibration isolators for outdoor equipment to comply with wind design requirements.
4. Select vibration-isolated equipment support bases and associated vibration isolators to provide minimum 2-inch operating clearance beneath base unless otherwise indicated.

D. Equipment Isolation:

1. Transformers:
   a. Specified vibration isolators are in addition to any factory-installed internal core and coil assembly vibration isolators unless otherwise indicated.
   b. Floor-Mounted Transformers, Nonseismic Applications: Use resilent material isolator pads, resilient material isolator mounts, or open (unhoused) spring isolators.
   c. Suspended Transformers, Nonseismic Applications: Use resilient material isolator hangers, spring isolator hangers, or combination resilient material/spring isolator hangers.
   d. Wall-Mounted Transformers, Nonseismic Applications: Use resilient material isolator mounts.
   e. Minimum Static Deflection:
      1) Transformers Mounted on Grade-Level Slabs: 0.25 inch deflection unless otherwise indicated.
      2) Transformers Mounted at Above-Grade Levels: 0.5 inch deflection unless otherwise indicated.
2. Engine Generators:
   a. Specified vibration isolators are in addition to any factory-installed internal vibration isolators between generator set and integral base unless otherwise indicated; obtain generator set manufacturer approval of applied vibration isolation.
   b. Nonseismic Applications, Isolators Not Located Below Sub-Base Fuel Tank: Use housed spring isolators or restrained spring isolators.
   c. Provide vibration-isolated concrete inertia bases.
   d. Minimum Static Deflection:
      1) Generators Mounted at Above-Grade Levels: 2 inch deflection unless otherwise indicated.

E. Conduit Isolation:

1. Use flexible conduit or cable for electrical connections to vibration-isolated equipment, including equipment installed under other sections or by others.
   a. Minimum Length: 3 feet unless otherwise indicated.
2. Vibration Isolators:
   a. Provide vibration isolators for conduit supports:
      1) Located within 50 feet of connected vibration-isolated equipment where flexible connection to equipment is not possible.
      2) For conduits over 2 inch trade size located below or within 50 feet of noise-sensitive areas indicated.
   b. Minimum Static Deflection:
      1) First Three Supports Closest to Isolated Equipment: Same as static deflection of equipment; maximum of 2 inch deflection required.
      2) Remainder of Supports: 0.75 inch deflection unless otherwise indicated.
   c. Suspended Conduits, Nonseismic Applications: Use resilient material isolator hangers, spring isolator hangers, or combination resilient material/spring isolator hangers.
   d. Use modular seal or approved resilient material where vibration-isolated conduits penetrate building elements (e.g., walls, floors) arranged to prevent vibration transmission to structure.

2.2 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

A. Manufacturers:

1. Vibration-Isolated Equipment Support Bases:
   a. Kinetics Noise Control, Inc; _____: www.kineticsnoise.com/#sle.
   b. Mason Industries; _____: www.mason-ind.com/#sle.
   c. Vibration Eliminator Company, Inc; _____: www.veco-nyc.com/#sle.
2. Substitutions: See Section 01.6000 - Product Requirements.
3. Source Limitations: Furnish vibration-isolated equipment support bases and associated components and accessories produced by the same manufacturer as the vibration isolators and obtained from a single supplier.

B. Vibration-Isolated Structural Steel Bases:

1. Description: Engineered structural steel frames with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.

C. Vibration-Isolated Concrete Inertia Bases:

1. Description: Concrete-filled engineered steel forms with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.
2. Minimum Base Depth: 6 inches.
3. Minimum Base Mass (Including Concrete): 1.5 times weight of supported equipment.
4. Concrete Reinforcement: Welded or tied reinforcing bars running both ways in a single layer.
5. Concrete: Filled on site with minimum 3000 psi concrete in accordance with Section 03.3000.

2.3 VIBRATION ISOLATORS

A. Manufacturers:

1. Vibration Isolators:
   a. ANDRE HVAC International, Inc: www.andrehvac.com/#sle.
   b. Kinetics Noise Control, Inc; _____: www.kineticsnoise.com/#sle.
   c. Mason Industries; _____: www.mason-ind.com/#sle.
   d. Vibration Eliminator Company, Inc; _____: www.veco-nyc.com/#sle.
2. Substitutions: See Section 01.6000 - Product Requirements.
3. Source Limitations: Furnish vibration-isolators and associated accessories produced by a single manufacturer and obtained from a single supplier.

B. General Requirements:

1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
2. Spring Elements for Spring Isolators:
   a. Color code or otherwise identify springs to indicate load capacity.
   b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
   c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
   d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
   e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
   f. Selected to function without undue stress or overloading.

C. Vibration Isolators for Nonseismic Applications:

1. Resilient Material Isolator Pads:
   a. Description: Single or multiple layer pads utilizing elastomeric (e.g., neoprene, rubber) isolator material.
   b. Pad Thickness: As required for specified minimum static deflection; minimum 0.25 inch thickness.
   c. Multiple Layer Pads: Provide bonded, galvanized sheet metal separation plate between each layer.
2. Resilient Material Isolator Mounts, Nonseismic:
   a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material; fail-safe type.
3. Open (Unhoused) Spring Isolators:
   a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) without a housing.
   b. Bottom Load Plate: Nonskid, molded, elastomeric isolator material or steel with nonskid elastomeric isolator pad with provisions for bolting to supporting structure as required.
   c. Furnished with integral leveling device for positioning and securing supported equipment.
4. Housed Spring Isolators:
   a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing.

b. Furnished with integral elastomeric snubbing elements, nonadjustable type, for limiting equipment movement and preventing metal-to-metal contact between housing elements.
c. Bottom Load Plate: Steel with nonskid, elastomeric isolator pad with provisions for bolting to supporting structure as required.
d. Furnished with integral leveling device for positioning and securing supported equipment.

5. Restrained Spring Isolators, Nonseismic:
   a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop.
   b. Bottom Load Plate: Steel with nonskid, elastomeric isolator pad with provisions for bolting to supporting structure as required.
   c. Furnished with integral leveling device for positioning and securing supported equipment.
   d. Provides constant free and operating height.
6. Resilient Material Isolator Hangers, Nonseismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material for the lower hanger rod connection.
7. Spring Isolator Hangers, Nonseismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection.
   b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
8. Combination Resilient Material/Spring Isolator Hangers, Nonseismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g., neoprene, rubber) or fiberglass isolator material for the upper hanger rod connection.
   b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 CODE-REQUIRED SPECIAL INSPECTIONS

A. Arrange work to accommodate tests and/or inspections performed by Special Inspection Agency employed by Owner or Architect in accordance with Section 01.4533 and statement of special inspections as required by applicable building code.

B. Frequency of Special Inspections: Where special inspections are designated as continuous or periodic, arrange work accordingly.

1. Continuous Special Inspections: Special Inspection Agency to be present in the area where the work is being performed and observe the work at all times the work is in progress.
2. Periodic Special Inspections: Special Inspection Agency to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

C. Prior to starting work, Contractor to submit written statement of responsibility to authorities having jurisdiction and to Owner acknowledging awareness of special requirements contained in the statement of special inspections.

D. Special Inspection Agency services do not relieve Contractor from performing inspections and testing specified elsewhere.

3.3 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install products in accordance with applicable requirements of NECA 1 (general workmanship).

C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

D. Secure fasteners according to manufacturer's recommended torque settings.

E. Install flexible conduit and cable connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

F. Vibration Isolation Systems:

1. Vibration-Isolated Equipment Support Bases:
   a. Provide specified minimum clearance beneath base.
2. Spring Isolators:
   a. Position equipment at operating height; provide temporary blocking as required.
   b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
   c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
3. Isolator Hangers:
   a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
   b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.
4. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.

5. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
6. Adjust isolators to be free of isolation short circuits during normal operation.
7. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

3.4 FIELD QUALITY CONTROL

A. See Section 01.4000 - Quality Requirements, for additional requirements.

B. Inspect vibration isolation and/or seismic control components for damage and defects.

C. Vibration Isolation Systems:

1. Verify isolator static deflections.
2. Verify required clearance beneath vibration-isolated equipment support bases.
3. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.

D. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

E. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION 26.0548

SECTION 26.0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Voltage markers.

E. Underground warning tape.

F. Floor marking tape.

G. Warning signs and labels.

1.2 RELATED REQUIREMENTS

A. Section 09.9113 - Exterior Painting.

B. Section 09.9123 - Interior Painting.

C. Section 26.0519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

D. Section 26.0573 - Power System Studies: Arc flash hazard warning labels.

E. Section 26.2300 - Low-Voltage Switchgear: Factory-installed mimic bus.

F. Section 26.2726 - Wiring Devices: Device and wallplate finishes; factory pre-marked wallplates.

G. Section 27.1000 - Structured Cabling: Identification for communications cabling and devices.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:

1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
2. Do not install identification products until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. See Section 01.3000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

D. Samples:

1. Identification Nameplates: One of each type and color specified.

E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.7 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.1 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:

1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
   a. Switchboards:
      1) Identify ampere rating.
      2) Identify voltage and phase.
      3) Identify power source and circuit number. Include location when not within sight of equipment.
      4) Use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.
   b. Panelboards:
      1) Identify ampere rating.
      2) Identify voltage and phase.
      3) Identify power source and circuit number. Include location when not within sight of equipment.
      4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.

5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces.
6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.

c. Enclosed switches, circuit breakers, and motor controllers:
1) Identify voltage and phase.
2) Identify power source and circuit number. Include location when not within sight of equipment.
3) Identify load(s) served. Include location when not within sight of equipment.

d. Time Switches:
1) Identify load(s) served and associated circuits controlled. Include location.

e. Enclosed Contactors:
1) Identify voltage and phase.
2) Identify configuration, e.g., E.O.E.H. (electrically operated, electrically held) or E.O.M.H. (electrically operated, mechanically held).
3) Identify coil voltage.
4) Identify load(s) and associated circuits controlled. Include location.

f. Transfer Switches:
1) Identify voltage and phase.
2) Identify power source and circuit number for both normal power source and standby power source. Include location.
3) Identify load(s) served. Include location.
4) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.

g. Electricity Meters:
1) Identify load(s) metered.

2. Service Equipment:
a. Use identification nameplate to identify each service disconnecting means.

3. Emergency System Equipment:
a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
c. Use identification nameplate to identify emergency operating instructions for emergency system equipment.

4. Use voltage marker to identify highest voltage present for each piece of electrical equipment.
5. Use identification nameplate to identify equipment utilizing series ratings, where permitted, in accordance with NFPA 70.
6. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
7. Use identification label on inside of door at each fused switch to identify required NEMA fuse class and size.

8. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
9. Use floor marking tape to identify required equipment working clearances.
10. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
    a. Service equipment.
    b. Industrial control panels.
    c. Motor control centers.
    d. Elevator control panels.
    e. Industrial machinery.
11. Arc Flash Hazard Warning Labels: Comply with Section 26.0573.

B. Identification for Conductors and Cables:

1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26.0519.
2. Identification for Communications Conductors and Cables: Comply with Section 271005.
3. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
4. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
    a. At each source and load connection.
    b. Within boxes when more than one circuit is present.
    c. Within equipment enclosures when conductors and cables enter or leave the enclosure.
    d. In cable tray, at maximum intervals of 20 feet.
5. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.
6. Use underground warning tape to identify direct buried cables.

C. Identification for Raceways:

1. Use voltage markers, color-coded bands, or factory-painted conduits to identify systems other than normal power system for accessible conduits.
    a. Maximum Intervals: 20 feet.
    b. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches wide.
        1) Field-Painting: Comply with Section 09.9123 and 09.9113.
        2) Vinyl Color Coding Electrical Tape: Comply with Section 26.0519.
    c. Color Code:
        1) Emergency Power System:
            (a) Life Safety Branch: Red.
        2) Fire Alarm System: Red.
2. Use identification labels or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.

3. Use identification labels or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
4. Use underground warning tape to identify underground raceways.
5. Use voltage markers to identify highest voltage present for wireways at maximum intervals of 20 feet.

D. Identification for Boxes:

1. Use voltage markers to identify highest voltage present.
2. Use voltage markers or color coded boxes to identify systems other than normal power system.
   a. Color-Coded Boxes: Field-painted in accordance with Section 09.9123 and 09.9113 per the same color code used for raceways.
3. Use identification labels to identify circuits enclosed.
4. Use warning labels to identify electrical hazards for boxes containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".

E. Identification for Devices:

1. Identification for Communications Devices: Comply with Section 271005.
2. Wiring Device and Wallplate Finishes: Comply with Section 26.2726.
3. Factory Pre-Marked Wallplates: Comply with Section 26.2726.
4. Use identification label to identify fire alarm system devices.
   a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
5. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.
   a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.

2.2 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:

1. Manufacturers:
   a. Brimar Industries, Inc: www.brimar.com/#sle.
   b. Kolbi Pipe Marker Co; _____: www.kolbipipemarkers.com/#sle.
   c. Seton Identification Products; _____: www.seton.com/#sle.
   d. Substitutions: See Section 01.6000 - Product Requirements.
2. Materials:
   a. Indoor Clean, Dry Locations: Use plastic nameplates.
   b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
   a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.
4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
5. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.

6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:

1. Manufacturers:
   a. Brady Corporation; _____: www.bradyid.com/#sle.
   b. Brother International Corporation: www.brother-usa.com/#sle.
   c. Panduit Corp: www.panduit.com/#sle.
   d. Substitutions: See Section 01.6000 - Product Requirements.
2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
   a. Use only for indoor locations.
3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:

1. Minimum Size: 1 inch by 2.5 inches.
2. Legend:
   a. System designation where applicable:
      1) Emergency Power System: Identify with text "EMERGENCY".
      2) Fire Alarm System: Identify with text "FIRE ALARM".
   b. Equipment designation or other approved description.
   c. Other information as indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height:
   a. System Designation: 1 inch.
   b. Equipment Designation: 1/2 inch.
   c. Other Information: 1/4 inch.
   d. Exception: Provide minimum text height of 1 inch for equipment located more than 10 feet above floor or working platform.
5. Color:
   a. Normal Power System: White text on black background.
   b. Emergency Power System:
      1) Life Safety Branch: White text on Red background.
   c. Fire Alarm System: White text on red background.

D. Format for General Information and Operating Instructions:

1. Minimum Size: 1 inch by 2.5 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/4 inch.
5. Color: Black text on white background unless otherwise indicated.
   a. Exceptions:

1) Provide white text on red background for general information or operational instructions for emergency systems.
2) Provide white text on red background for general information or operational instructions for fire alarm systems.

E. Format for Caution and Warning Messages:

1. Minimum Size: 2 inches by 4 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/2 inch.
5. Color: Black text on yellow background unless otherwise indicated.

F. Format for Receptacle Identification:

1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Power source and circuit number or other designation indicated.
   a. Include voltage and phase for other than 120 V, single phase circuits.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

G. Format for Fire Alarm Device Identification:

1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Designation indicated and device zone or address.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Red text on white background.

2.3 WIRE AND CABLE MARKERS

A. Manufacturers:

1. Brady Corporation; _____: www.bradyid.com/#sle.
2. HellermannTyton; _____: www.hellermanntyton.com/#sle.
3. Panduit Corp: www.panduit.com/#sle.
4. Substitutions: See Section 01.6000 - Product Requirements.

B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

D. Legend: Power source and circuit number or other designation indicated.

E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

F. Minimum Text Height: 1/8 inch.

G. Color: Black text on white background unless otherwise indicated.

2.4 VOLTAGE MARKERS

A. Manufacturers:

1. Brady Corporation; _____: www.bradyid.com/#sle.
2. Brimar Industries, Inc: www.brimar.com/#sle.
3. Seton Identification Products; _____: www.seton.com/#sle.
4. Substitutions: See Section 01.6000 - Product Requirements.

B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

C. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

D. Minimum Size:

1. Markers for Equipment: 1 1/8 by 4 1/2 inches.
2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
3. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
4. Markers for Junction Boxes: 1/2 by 2 1/4 inches.

E. Legend:

1. Markers for Voltage Identification: Highest voltage present.
2. Markers for System Identification:
    a. Emergency Power System: Text "EMERGENCY".

F. Color: Black text on orange background unless otherwise indicated.

2.5 UNDERGROUND WARNING TAPE

A. Manufacturers:

1. Brady Corporation: www.bradyid.com/#sle.
2. Brimar Industries, Inc: www.brimar.com/#sle.
3. Seton Identification Products: www.seton.com/#sle.
4. Substitutions: See Section 01.6000 - Product Requirements.

B. Material: Polyethylene tape suitable for direct burial.

C. Use detectable tape for open trench applications, unless otherwise indicated.

D. Nondetectable Tape for Open Trench Applications: 6 inches wide, with minimum thickness of 4 mils, 0.0004 inch.

E. Detectable Tape for Open Trench Applications: 4 inches wide, with minimum thickness of 5 mils, 0.0005 inch; provide integral foil core or tracer wire for detection by locator.

F. Legend: Type of service, continuously repeated over full length of tape.

G. Color:

1. Buried Electrical Lines: Black text on red background.
2. Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.6 FLOOR MARKING TAPE

A. Manufacturers:

1. Brady Corporation; _____: www.bradyid.com/#sle.
2. Brimar Industries, Inc: www.brimar.com/#sle.
3. Insite Solutions, LLC; _____: www.stop-painting.com/#sle.
4. Substitutions: See Section 01.6000 - Product Requirements.

B. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlaminate, 3 inches wide, with alternating black and white stripes.

2.7 WARNING SIGNS AND LABELS

A. Manufacturers:

1. Brimar Industries, Inc: www.brimar.com/#sle.
2. Clarion Safety Systems, LLC; _____: www.clarionsafety.com/#sle.
3. Insite Solutions, LLC; _____: www.stop-painting.com/#sle.
4. Seton Identification Products; _____: www.seton.com/#sle.
5. Substitutions: See Section 01.6000 - Product Requirements.

B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

C. Warning Signs:

1. Materials:
   a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
   b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
3. Minimum Size: 7 by 10 inches unless otherwise indicated.

D. Warning Labels:

1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
   a. Do not use labels designed to be completed using handwritten text.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches unless otherwise indicated.

E. Floor Signs:

1. Materials: Use factory preprinted, self-adhesive vinyl, polyester, or rubber labels with protective overlaminate; removable.
2. Minimum Size: 17-inch diameter unless otherwise indicated.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:

1. Surface-Mounted Equipment: Enclosure front.
2. Flush-Mounted Equipment: Inside of equipment door.
3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
4. Elevated Equipment: Legible from the floor or working platform.
5. Branch Devices: Adjacent to device.
6. Interior Components: Legible from the point of access.
7. Conduits: Legible from the floor.
8. Boxes: Outside face of cover.
9. Conductors and Cables: Legible from the point of access.
10. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

1. Do not use adhesives on exterior surfaces except where substrate cannot be penetrated.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.

G. Secure rigid signs using stainless steel screws.

H. Mark all handwritten text, where permitted, to be neat and legible.

3.3 FIELD QUALITY CONTROL

A. See Section 01.4000 - Quality Requirements, for additional requirements.

B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION 26.0553

SECTION 26.0573 - POWER SYSTEM STUDIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Short-circuit study.

B. Protective device coordination study.

C. Arc flash and shock risk assessment.

1. Includes arc flash hazard warning labels.

D. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.2 RELATED REQUIREMENTS

A. Section 26.0553 - Identification for Electrical Systems: Additional requirements for arc flash hazard warning labels.

B. Section 26.2100 - Low-Voltage Electrical Service Entrance.

1. Includes Utility Company contact information.

C. Section 26.2300 - Low-Voltage Switchgear.

D. Section 26.2413 - Switchboards.

E. Section 26.2416 - Panelboards.

F. Section 26.2813 - Fuses.

G. Section 26.2816.13 - Enclosed Circuit Breakers.

H. Section 26.2816.16 - Enclosed Switches.

1.3 REFERENCE STANDARDS

A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2023.

B. IEEE 141 - IEEE Recommended Practice for Electric Power Distribution for Industrial Plants; 1993 (Reaffirmed 1999).

C. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems; 2001, with Errata (2003).

D. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis; 1997.

E. IEEE 551 - IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems; 2006.

F. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations; 2018, with Errata (2019).

G. NEMA MG 00001 - Motors and Generators; 2024.

H. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. NFPA 70E - Standard for Electrical Safety in the Workplace; 2027.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
2. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Pre-Study Meeting: Conduct meeting with Engineer to discuss system operating modes and conditions to be considered in studies.

C. Sequencing:

1. Submit study reports prior to or concurrent with product submittals.
2. Do not order equipment until matching study reports and product submittals have both been evaluated by Architect.
3. Verify naming convention for equipment identification prior to creation of final drawings, reports, and arc flash hazard warning labels (where applicable).

1.5 SUBMITTALS

A. See Section 01.3000 - Administrative Requirements, for submittal procedures.

B. Study preparer's qualifications.

C. Field testing agency's qualifications.

D. Study reports, stamped or sealed and signed by study preparer.

E. Product Data: In addition to submittal requirements specified in other sections, include manufacturer's standard catalog pages and data sheets for equipment and protective devices indicating information relevant to studies.

1. Include characteristic time-current trip curves for protective devices.
2. Include impedance data for busway.
3. Include impedance data for engine generators.
4. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
5. Include documentation of listed series ratings upon request.
6. Identify modifications made in accordance with studies that:
    a. Can be made at no additional cost to Owner.
    b. As submitted will involve a change to the contract sum.

F. Arc Flash Hazard Warning Label Samples: One of each type and legend specified.

G. Site-specific arc flash hazard warning labels.

H. Field quality control reports.

I. Certification that field adjustable protective devices have been set in accordance with requirements of studies.

J. Project Record Documents: Revise studies as required to reflect as-built conditions.

1. Include hard copies with operation and maintenance data submittals.
2. Include computer software files used to prepare studies with file name(s) cross-referenced to specific pieces of equipment and systems.

1.6 POWER SYSTEM STUDIES

A. Scope of Studies:

1. Perform analysis of new electrical distribution system.
2. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).
3. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.
    a. Known Operating Modes:
        1) Utility as source.
        2) Generator as source.
        3) Maintenance settings.

B. General Study Requirements:

1. Comply with NFPA 70.
2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.

C. Data Collection:

1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.
    a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
        1) Obtain up-to-date information from Utility Company.
        2) Utility Company: See Section 26.2100 for Utility Company contact information.
    b. Generators: Include manufacturer/model, kW and voltage ratings, and impedance.
    c. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 00001 code letter designation.
    d. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.
    e. Protective Devices:
        1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available

field-adjustable trip response settings, and features (e.g. zone selective interlocking).

2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).

f. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.

g. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.

D. Short-Circuit Study:

1. Comply with IEEE 551 and applicable portions of IEEE 141, IEEE 242, and IEEE 399.
2. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:
   a. Maximum utility fault currents.
   b. Maximum motor contribution.
   c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
3. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.

E. Protective Device Coordination Study:

1. Comply with applicable portions of IEEE 242 and IEEE 399.
2. Analyze alternate scenarios considering known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
3. Analyze protective devices and associated settings for suitable margins between time-current curves to provide adequate protection for equipment and conductors while achieving full selective coordination.

F. Arc Flash and Shock Risk Assessment:

1. Comply with NFPA 70E.
2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.
   a. Where reasonable, study preparer may assume a maximum clearing time of two seconds in accordance with IEEE 1584, provided that the conditions are such that a worker's egress from an arc flash event would not be inhibited.
   b. For single-phase systems, study preparer to perform calculations assuming three-phase system in accordance with IEEE 1584 using single phase bolted fault current, yielding conservative results.
3. For equipment with main devices mounted in separate compartmentalized sections, perform calculations on both the line and load side of the main device.
4. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:
   a. Maximum and minimum utility fault currents.
   b. Maximum and minimum motor contribution.

c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

G. Study Reports:

1. General Requirements:
   a. Identify date of study and study preparer.
   b. Identify study methodology and software product(s) used.
   c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
   d. Identify base used for per unit values.
   e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.
   f. Include conclusions and recommendations.
2. Short-Circuit Study:
   a. For each scenario, identify at each bus location:
      1) Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).
      2) Fault point X/R ratio.
      3) Associated equipment short circuit current ratings.
   b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.
3. Protective Device Coordination Study:
   a. For each scenario, include time-current coordination curves plotted on log-log scale graphs.
   b. For each graph include (where applicable):
      1) Partial single-line diagram identifying the portion of the system illustrated.
      2) Protective Devices: Time-current curves with applicable tolerance bands for each protective device in series back to the source, plotted up to the maximum available fault current at the associated bus.
      3) Conductors: Damage curves.
      4) Transformers: Inrush points and damage curves.
      5) Generators: Full load current, overload curves, decrement curves, and short circuit withstand points.
      6) Motors: Full load current, starting curves, and damage curves.
      7) Capacitors: Full load current and damage curves.
   c. For each protective device, identify fixed and adjustable characteristics with available ranges and recommended settings.
      1) Circuit Breakers: Include long time pickup and delay, short time pickup and delay, and instantaneous pickup.
      2) Include ground fault pickup and delay.
      3) Include fuse ratings.
      4) Protective Relays: Include current/potential transformer ratios, tap, time dial, and instantaneous pickup.

d. Identify cases where either full selective coordination or adequate protection is not achieved, along with recommendations.

4. Arc Flash and Shock Risk Assessment:
   a. For the worst case for each scenario, identify at each bus location:
      1) Calculated incident energy and associated working distance.
      2) Calculated arc flash boundary.
      3) Bolted fault current.
      4) Arcing fault current.
      5) Clearing time.
      6) Arc gap distance.
   b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.
   c. Include recommendations for reducing the incident energy at locations where the calculated maximum incident energy exceeds 40 calories per sq cm.

1.7 QUALITY ASSURANCE

A. Study Preparer Qualifications: Professional electrical engineer licensed in the State in which the Project is located and with minimum five years experience in preparation of studies of similar type and complexity using specified computer software.

1. Study preparer may be employed by manufacturer of electrical distribution equipment.
2. Study preparer may be employed by field testing agency.

B. Field Testing Agency Qualifications: Independent testing organization specializing in testing, analysis, and maintenance of electrical systems with minimum five years experience; NETA Accredited Company.

1. Field Supervisor: Certified electrical testing technician; NETA ETT Level III.

C. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.

1. Products:
   a. EasyPower LLC: www.easypower.com/#sle.
   b. ETAP/Operation Technology, Inc: www.etap.com/#sle.
   c. Power Analytics Corporation: www.poweranalytics.com/#sle.
   d. SKM Systems Analysis, Inc: www.skm.com/#sle.
   e. Substitutions: See Section 01.6000 - Product Requirements.

PART 2 PRODUCTS

2.1 ARC FLASH HAZARD WARNING LABELS

A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.

1. Materials: Comply with Section 26.0553.

2. Minimum Size: 4 by 6 inches.
3. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.
    a. Include orange header that reads "WARNING" unless otherwise indicated.
    b. Include the text "Arc Flash and Shock Hazard; Appropriate PPE Required" or approved equivalent.
    c. Include the following information:
        1) Arc flash boundary.
        2) Available incident energy and corresponding working distance.
        3) Site-specific PPE (personnel protective equipment) requirements.
        4) Nominal system voltage.
        5) Limited approach boundary.
        6) Restricted approach boundary.
        7) Equipment identification.
        8) Study preparer, report reference, and date calculations were performed.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install arc flash warning labels in accordance with Section 26.0553.

3.2 FIELD QUALITY CONTROL

A. See Section 01.4000 - Quality Requirements, for additional requirements.

B. Provide the services of field testing agency or equipment manufacturer's representative to perform inspection, testing, and adjusting.

C. Inspect and test in accordance with NETA ATS, except Section 4.

D. Adjust equipment and protective devices for compliance with studies and recommended settings.

E. Notify Architect of any conflicts with or deviations from studies. Obtain direction before proceeding.

F. Submit detailed reports indicating inspection and testing results, and final adjusted settings.

3.3 CLOSEOUT ACTIVITIES

A. See Section 01.7800 - Closeout Submittals, for closeout submittals.

B. See Section 01.7900 - Demonstration and Training, for additional requirements.

C. Training: Include as part of the base bid training for Owner's personnel on electrical safety pertaining to arc flash and shock hazards.

1. Use site-specific arc flash and shock risk assessment report as training reference, supplemented with additional training materials as required.
2. Provide minimum of eight hours of training.
3. Instructor: Representative of entity performing study.

4. Location: At project site.

END OF SECTION 26.0573

SECTION 26.0923 - LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Occupancy sensors.

B. Outdoor photo controls.

1.2 RELATED REQUIREMENTS

A. Section 26.0526 - Grounding and Bonding for Electrical Systems.

B. Section 26.0537 - Boxes.

C. Section 26.0553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26.2726 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, fan-speed controllers, and wall plates.

E. Section 26.5100 - Interior Lighting.

F. Section 26.5600 - Exterior Lighting.

1.3 REFERENCE STANDARDS

A. ANSI C136.24 - American National Standard for Roadway and Area Lighting Equipment - Nonlocking (Button) Type Photocontrols; 2004 (R2010).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2008.

D. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Fluorescent Ballasts; National Electrical Manufacturers Association; 2011.

E. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 773 - Plug-in Locking Type Photocontrols for Use with Area Lighting; Current Edition, Including All Revisions.

G. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control; Current Edition, Including All Revisions.

H. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.

I. UL 917 - Clock-Operated Switches; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
4. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
5. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:

1. Do not install lighting control devices until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. See Section 01.3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.

C. Shop Drawings:

1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.

D. Field Quality Control Reports.

E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Operation and Maintenance Data: Include detailed information on device programming and setup.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01.6000 - Product Requirements, for additional provisions.

H. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for all occupancy sensors.

PART 2 PRODUCTS

2.1 ALL LIGHTING CONTROL DEVICES

A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

2.2 OCCUPANCY SENSORS

A. Manufacturers:

1. Manufacturer: Wattstopper DLM
2. Other acceptable manufacturers:
   a. Leviton GreenMax
   b. Lutron

B. All Occupancy Sensors:

1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
2. Sensor Technology:
   a. Passive Infrared (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.
   b. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.
   c. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
6. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.
7. Turn-Off Delay: Field adjustable, up to a maximum time delay setting of not less than 15 minutes and not more than 30 minutes.
8. Sensitivity: Field adjustable.
9. Adaptive Technology: Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.
10. Integral Photocell: For field selectable and adjustable inhibition of automatic turn-on of load

when ambient lighting is above the selected level.

11. Compatibility: Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
12. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on the drawings.
13. Isolated Relay for Low Voltage Occupancy Sensors: SPDT dry contacts, ratings as required for interface with system indicated.

C. Wall Switch Occupancy Sensors:

1. All Wall Switch Occupancy Sensors:
    a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
    b. Unless otherwise indicated or required to control the load indicated on the drawings, provide line voltage units with self-contained relay.
    c. Where indicated, provide two-circuit units for control of two separate lighting loads, with separate manual controls and separately programmable operation for each load.
    d. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
    e. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
2. Passive Infrared (PIR) Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.
3. Ultrasonic Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 400 square feet.
4. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.

D. Ceiling Mounted Occupancy Sensors:

1. All Ceiling Mounted Occupancy Sensors:
    a. Description: Low profile occupancy sensors designed for ceiling installation.
    b. Unless otherwise indicated or required to control the load indicated on the drawings, provide low voltage units, for use with separate compatible accessory power packs.
    c. Provide field selectable setting for disabling LED motion detector visual indicator.
    d. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
    e. Finish: White unless otherwise indicated.
2. Passive Infrared (PIR) Ceiling Mounted Occupancy Sensors:
    a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
    b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet

at a mounting height of 9 feet, with a field of view of 360 degrees.

3. Ultrasonic Ceiling Mounted Occupancy Sensors:
   a. Standard Range Sensors: Capable of detecting motion within an area of 500 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
   b. Extended Range Sensors: Capable of detecting motion within an area of 2,000 square feet at a mounting height of 9 feet.
   c. Microphonic occupancy sensors will not be accepted as a substitution for ultrasonic technology.
4. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
   a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
   b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.

E. Power Packs for Low Voltage Occupancy Sensors:

1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on the drawings.
3. Input Supply Voltage: Dual rated for 120/277 V ac.
4. Load Rating: As required to control the load indicated on the drawings.

2.3 OUTDOOR PHOTO CONTROLS

A. Manufacturers:

1. Intermatic, Inc: www.intermatic.com.
2. Paragon, a brand of Invensys Controls: www.invensyscontrols.com.
3. Tork, a division of NSI Industries LLC: www.tork.com.
4. Substitutions: See Section 01.6000 - Product Requirements.
5. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. Stem-Mounted Outdoor Photo Controls:

1. Description: Direct-wired photo control unit with threaded conduit mounting stem and field-adjustable swivel base, listed and labeled as complying with UL 773A.
2. Housing: Weatherproof, impact resistant polycarbonate.
3. Photo Sensor: Cadmium sulfide.
4. Provide external sliding shield for field adjustment of light level activation.
5. Light Level Activation: 1 to 5 footcandles turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
6. Voltage: As required to control the load indicated on the drawings.
7. Failure Mode: Fails to the on position.
8. Load Rating: As required to control the load indicated on the drawings.

9. Provide accessory wall-mounting bracket where indicated or as required to complete installation.

C. Locking Receptacle-Mounted Outdoor Photo Controls

1. Description: Plug-in locking type photo control unit complying with ANSI C136.10 for mounting on a compatible receptacle, listed and labeled as complying with UL 773.
2. Housing: Weatherproof, impact resistant UV stabilized polypropylene, color to be selected.
3. Photo Sensor: Cadmium sulfide.
4. Light Level Activation: 1 to 3 footcandles turn-on and 1.5 to 1 turn-off to turn-on ratio with instant turn-on and delayed turn-off.
5. Voltage: As required to control the load indicated on the drawings.
6. Failure Mode: Fails to the on position.
7. Load Rating: As required to control the load indicated on the drawings.
8. Surge Protection: 160 joule metal oxide varistor.

D. Button Type Outdoor Photo Controls

1. Description: Direct-wired photo control unit complying with ANSI C136.24 with weatherproof gasketed wall plate where required or indicated, listed and labeled as complying with UL 773A.
2. Housing: Weather resistant polycarbonate.
3. Photo Sensor: Cadmium sulfide.
4. Light Level Activation: 1 to 3 footcandles turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
5. Voltage: As required to control the load indicated on the drawings.
6. Failure Mode: Fails to the on position.
7. Load Rating: As required to control the load indicated on the drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service

voltage and load requirements at the location to be installed.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 260537 as required for installation of lighting control devices provided under this section.

1. Mounting Heights: Unless otherwise indicated, as follows:
   a. Wall Switch Occupancy Sensors: 48 inches above finished floor to the top of the box.

C. Install lighting control devices in accordance with manufacturer's instructions.

D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

E. Install lighting control devices plumb and level, and held securely in place.

F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26.2726.

G. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

H. Identify lighting control devices in accordance with Section 26.0553.

I. Occupancy Sensor Locations:

1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.

2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

J. Outdoor Photo Control Locations:

1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself.

K. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.

L. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near the sensor location.

M. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.

3.4 FIELD QUALITY CONTROL

A. See Section 01.4000 - Quality Requirements, for additional requirements.

B. Inspect each lighting control device for damage and defects.

C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.

D. Test outdoor photo controls to verify proper operation, including time delays where applicable.

E. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.5 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.

C. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.

D. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Architect.

3.6 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.7 CLOSEOUT ACTIVITIES

A. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours of training.
3. Instructor: Qualified contractor familiar with the project and with sufficient knowledge of the installed lighting control devices.
4. Location: At project site.

END OF SECTION 26.0923

SECTION 26.2100 - LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical service requirements.

1.2 RELATED REQUIREMENTS

A. Section 03.3000 - Cast-in-Place Concrete: Materials and installation requirements for cast-in-place concrete equipment pads.

B. Section 26.0519 - Low-Voltage Electrical Power Conductors and Cables.

C. Section 26.0526 - Grounding and Bonding for Electrical Systems.

D. Section 26.0529 - Hangers and Supports for Electrical Systems.

E. Section 26.0533.13 - Conduit for Electrical Systems.

F. Section 26.0553 - Identification for Electrical Systems: Identification products and requirements.

G. Section 26.2413 - Switchboards: Service entrance equipment.

H. Section 26.2416 - Panelboards: Service entrance equipment.

I. Section 26.2713 - Electricity Metering: Non-utility electrical metering.

J. Section 26.2816.16 - Enclosed Switches: Service entrance equipment.

K. Section 26.3213 - Engine Generators: Emergency/standby power systems for interconnection with normal utility electrical supply.

L. Section 26.3600 - Transfer Switches: Service entrance equipment.

M. Section 31.2316 - Excavation.

N. Section 31.2316.13 - Trenching: Excavating, bedding, and backfilling.

O. Section 31.2323 - Fill: Bedding and backfilling.

P. Section 33.7119 - Electrical Underground Ducts, Ductbanks, and Manholes.

1.3 PRICE AND PAYMENT PROCEDURES

A. Allowances:

1. See Section 01.2100 - Allowances, for allowances affecting this section.
2. Include cash allowance for Utility Company charges associated with providing service.

B. Unit Prices:

1. See Section 01.2200 - Unit Prices, for additional unit price requirements.

1.4 DEFINITIONS

A. Service Point: The point of connection between the facilities of the serving utility and the premises wiring as defined in NFPA 70, and as designated by the Utility Company.

1.5 REFERENCE STANDARDS

A. IEEE C2 - National Electrical Safety Code(R) (NESC(R)); 2023.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.6 ADMINISTRATIVE REQUIREMENTS

A. No later than two weeks following date of the Agreement, notify Utility Company of anticipated date of service.

B. Coordination:

1. Verify the following with Utility Company representative:
   a. Utility Company requirements, including division of responsibility.
   b. Exact location and details of utility point of connection.
   c. Utility easement requirements.
   d. Utility Company charges associated with providing service.
2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for electrical service and associated equipment.
3. Coordinate arrangement of service entrance equipment with the dimensions and clearance requirements of the actual equipment to be installed.
4. Coordinate the work with other installers to provide communication lines required for Utility Company meters.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

C. Arrange for Utility Company to provide permanent electrical service. Prepare and submit documentation required by Utility Company.

D. Utility Company charges associated with providing permanent service to be paid by Owner.

E. Preinstallation Meeting: Convene one week prior to commencing work of this section to review service requirements and details with Utility Company representative.

F. Scheduling:

1. Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner.
2. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.7 SUBMITTALS

A. See Section 01.3000 - Administrative Requirements, for submittal procedures.

B. Utility Company letter of availability for providing electrical service to project.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product. Include ratings, configurations, standard wiring diagrams, outline and support point dimensions, finishes, weights, service condition requirements, and installed features.

D. Shop Drawings: Include dimensioned plan views and sections indicating locations and arrangement of Utility Company and service entrance equipment, metering provisions, required clearances, and proposed service routing.

1. Obtain Utility company approval of shop drawings prior to submittal.

E. Drawings prepared by Utility Company.

F. Project Record Documents: Record actual locations of equipment and installed service routing.

1.8 QUALITY ASSURANCE

A. Comply with the following:

1. IEEE C2 (National Electrical Safety Code).
2. NFPA 70 (National Electrical Code).
3. The requirements of the Utility Company.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Products: Listed, classified, and labeled as suitable for the purpose intended.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store products indoors in a clean, dry space having a uniform temperature to prevent condensation (including outdoor rated products which are not weatherproof until completely and properly installed). Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle products carefully to avoid damage to internal components, enclosure, and finish.

PART 2 PRODUCTS

2.1 ELECTRICAL SERVICE REQUIREMENTS

A. Provide new electrical service consisting of all required conduits, conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.

B. Electrical Service Characteristics: As indicated on drawings.

C. Utility Company: PECO.

1. Point of Contact: Nicholas Hatcher.
2. Email: Nicholas.Hatcher@exeloncorp.com.
3. Utility Company Project Reference Number: 20834405.

D. Division of Responsibility:

1. Pad-Mounted Utility Transformers:

a. Transformer Vaults and Pads: Furnished and installed by Contractor per Utility Company requirements.
b. Transformers: Furnished and installed by Utility Company.
c. Transformer Grounding Provisions: Furnished and installed by Contractor per Utility Company requirements.
d. Transformer Protective Bollards: Furnished and installed by Contractor per Utility Company requirements.
e. Primary:
1) Trenching and Backfilling: Provided by Contractor.
2) Conduits: Furnished and installed by Contractor.
3) Conductors: Furnished and Installed by Contractor.
f. Secondary:
1) Trenching and Backfilling: Provided by Contractor.
2) Conduits: Furnished and installed by Contractor.
3) Conductors: Furnished and installed by Contractor (Service Point at transformer).

2. Terminations at Service Point: Provided by Utility Company.
3. Metering Provisions:
a. Meter Bases: Furnished and installed by Contractor per Utility Company requirements.
b. Metering Compartments in Service Entrance Equipment: Furnished and installed by Contractor per Utility Company requirements.
c. Communications Conduits for Meters: Furnished and installed by Contractor per Utility Company requirements.

E. Products Furnished by Contractor: Comply with Utility Company requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings and configurations of service entrance equipment are consistent with the indicated requirements.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

3.3 INSTALLATION

A. Install products in accordance with manufacturer's instructions and Utility Company requirements.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances and required maintenance access.

D. Construct cast-in-place concrete pads for utility equipment in accordance with Utility Company requirements and Section 03.3000.

E. Provide required protective bollards in accordance with Utility Company requirements.

F. Provide required support and attachment components in accordance with Section 26.0529.

G. Provide grounding and bonding for service entrance equipment in accordance with Section 26.0526.

H. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 26.0553.

3.4 PROTECTION

A. Protect installed equipment from subsequent construction operations.

END OF SECTION 26.2100

SECTION 26.2413 - SWITCHBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Low-voltage (600 V and less) switchboards and associated accessories for service and distribution applications.

B. Overcurrent protective devices for switchboards.

1.2 RELATED REQUIREMENTS

A. Section 03.3000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 26.0526 - Grounding and Bonding for Electrical Systems.

C. Section 26.0529 - Hangers and Supports for Electrical Systems.

D. Section 26.0548 - Vibration and Seismic Controls for Electrical Systems.

1. Includes requirements for the seismic qualification of equipment specified in this section.

E. Section 26.0553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 26.0573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

G. Section 26.2100 - Low-Voltage Electrical Service Entrance.

1. Includes Utility Company contact information.

H. Section 26.2513 - Low-Voltage Busways.

I. Section 26.2713 - Electricity Metering: For interface with equipment specified in this section.

J. Section 26.2813 - Fuses: Fuses for fusible switches.

1. Includes requirements for spare fuses and spare fuse cabinets.

K. Section 26.4300 - Surge Protective Devices.

1.3 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).

B. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2016.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

D. NECA 400 - Standard for Installing and Maintaining Switchboards; 2007.

E. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

F. NEMA PB 2 - Deadfront Distribution Switchboards; 2011.

G. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 1000 Volts or Less; 2023.

H. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

K. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

L. UL 891 - Switchboards; Current Edition, Including All Revisions.

M. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Service Entrance Switchboards:

1. Coordinate with Utility Company to provide switchboards with suitable provisions for electrical service and utility metering, where applicable.
2. Coordinate with Owner to arrange for Utility Company required access to equipment for installation and maintenance.
3. See Section 26.2100 for Utility Company contact information and additional requirements.
4. Obtain Utility Company approval of switchboard prior to fabrication.
5. Preinstallation Meeting: Convene one week prior to commencing work of this section to review requirements with Utility Company representative.
6. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.5 SUBMITTALS

A. See Section 01.3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for switchboards, enclosures, overcurrent protective devices, and other installed components and accessories.

1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.

C. Shop Drawings: Indicate dimensions, voltage, bus ampacities, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Include dimensioned plan and elevation views of switchboards and adjacent equipment with all required clearances indicated.
2. Include wiring diagrams showing all factory and field connections.
3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
4. Include documentation of listed series ratings upon request.
5. Include documentation demonstrating selective coordination upon request.
6. Identify mounting conditions required for equipment seismic qualification.

D. Manufacturer's equipment seismic qualification certification.

E. Service Entrance Switchboards: Include documentation of Utility Company approval of switchboard.

F. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 2 as production (routine) tests.

G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

H. Field Quality Control Test Reports.

I. Project Record Documents: Record actual installed locations of switchboards and final equipment settings.

J. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01.6000 - Product Requirements, for additional provisions.
2. Enclosure Keys: Two of each different key.
3. Electronic Trip Circuit Breakers: Provide one portable test set.
4. Drawout Devices:
    a. Handles Necessary for Racking of Devices: One for each electrical room containing switchgear with drawout devices.
    b. Lifting Yokes: One of each different yoke required, for each electrical room containing drawout devices.
    c. Portable Lifting Devices: One for each electrical room containing switchboards with drawout devices and no integral top rail-mounted lifting device.
    d. Removable Covers: One for blocking each different opening size when device is temporarily removed from its compartment.
5. See Section 26.2813 for requirements for spare fuses and spare fuse cabinets.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store switchboards in accordance with manufacturer's instructions, NECA 400, and NEMA PB 2.1.

B. Store in a clean, dry space having a uniform temperature to prevent condensation (including outdoor switchboards, which are not weatherproof until completely and properly installed). Where necessary, provide temporary enclosure space heaters or temporary power for permanent factory-installed space heaters.

C. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

D. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Switchboards:

1. ABB: www.electrification.us.abb.com/#sle.
2. Eaton Corporation: www.eaton.com/#sle.
3. Schneider Electric: www.se.com/#sle.
4. Siemens Industry, Inc: www.new.siemens.com/#sle.
5. Substitutions: See Section 01.6000 - Product Requirements.
6. Source Limitations: Provide switchboards and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from single supplier.

2.2 SWITCHBOARDS

A. Provide switchboards consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Description: Dead-front switchboard assemblies complying with NEMA PB 2, and listed and labeled as complying with UL 891; ratings, configurations and features as indicated on the drawings.

D. Front-Connected Switchboards:

1. Main Device(s): Individually-mounted.
2. Feeder Devices: Panel/group-mounted.

3. Arrangement: Front and rear accessible, front and rear aligned.
4. Gutter Access: Bolted covers.

E. Service Entrance Switchboards:

1. Listed and labeled as suitable for use as service equipment according to UL 869A.
2. For solidly-grounded wye systems, provide factory-installed main bonding jumper between neutral and ground busses, and removable neutral disconnecting link for testing purposes.
3. Comply with Utility Company requirements for electrical service.
4. Utility Metering Provisions: Provide separate barriered compartment complying with Utility Company requirements where indicated or where required by Utility Company. Include hinged sealable door and provisions for Utility Company current transformers (CTs), potential transformers (PTs), or potential taps as required.
5. See Section 26.2100 for additional requirements.

F. Switchboards With Busway Transitions: Configured for bussed connection to busway provided in accordance with Section 26.2513.

G. Switchboards With Drawout Devices: Provide integral top rail-mounted lifting device where indicated.

H. Seismic Qualification: Provide switchboards and associated components suitable for application under the seismic design criteria specified in Section 26.0548 where required. Include certification of compliance with submittals.

I. Service Conditions:

1. Provide switchboards and associated components suitable for operation under the following service conditions without derating:
   a. Altitude: Less than 6,600 feet.
   b. Ambient Temperature:
      1) Switchboards Containing Molded Case or Insulated Case Circuit Breakers: Between 23 degrees F and 104 degrees F.
2. Provide switchboards and associated components suitable for operation at indicated ratings under the service conditions at the installed location.

J. Short Circuit Current Rating:

1. Provide switchboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
2. Minimum Rating: 100,000 rms symmetrical amperes.
3. Listed series ratings are acceptable, except where not permitted by motor contribution according to NFPA 70.
4. Label equipment utilizing series ratings as required by NFPA 70.

K. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

L. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide separate pull section and/or top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.

M. Bussing: Sized in accordance with UL 891 temperature rise requirements.

1. Through bus (horizontal cross bus) to be fully rated through full length of switchboard (non-tapered). Tapered bus is not permitted.

2. Provide fully rated neutral bus, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
3. Provide solidly bonded equipment ground bus through full length of switchboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
4. Phase and Neutral Bus Material: Copper.
5. Ground Bus Material: Copper.

N. Conductor Terminations: Suitable for use with the conductors to be installed.

1. Line Conductor Terminations:
   a. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   b. Main and Neutral Lug Type: Mechanical.
2. Load Conductor Terminations:
   a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   b. Lug Type:
      1) Provide mechanical lugs unless otherwise indicated.

O. Enclosures:

1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor Clean, Dry Locations: Type 1 or Type 2 (drip-proof).
   b. Outdoor Locations: Type 3R.
2. Finish: Manufacturer's standard unless otherwise indicated.
3. Enclosure Space Heaters:
   a. Provide in each switchboard section installed outdoors and in unconditioned indoor spaces.
   b. Size according to manufacturer's recommendations for worst case ambient temperature to prevent condensation.
   c. Heater Control: Thermostat.
   d. Heater Power Source: Provide connection to transformer factory-installed in switchboard or suitable external branch circuit as indicated or as required.
4. Outdoor Enclosures:
   a. Enclosure Type: Non-walk-in type unless otherwise indicated.
   b. Color: Manufacturer's standard.
   c. Access Doors: Lockable, with all locks keyed alike.

P. Future Provisions:

1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
2. Equip distribution sections with full height vertical bussing to accommodate maximum utilization of space for devices.
3. Arrange and equip through bus and ground bus to accommodate future installation of additional switchboard sections.

Q. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26.4300, list switchboards as a complete assembly including surge protective device.

R. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.

1. Where overcurrent protective devices equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
    a. Use zero sequence or residual ground fault detection method unless otherwise indicated.
    b. Provide test panel and field-adjustable ground fault pick-up and delay settings.
    c. Provide zone selective interlocking capability, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control ground fault delay functions for system coordination purposes.

S. Arc Flash Energy-Reducing Maintenance Switching: For circuit breakers rated 1200 A or higher, provide a local accessory switch with status indicator light that permits selection of a maintenance mode with alternate electronic trip unit settings for reduced fault clearing time.

T. Owner Metering:

1. Provide microprocessor-based digital electrical metering system including all instrument transformers, wiring, and connections necessary for measurements specified.
2. Measured Parameters:
    a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
    b. Current (Amps): For each phase and neutral.
    c. Frequency (Hz).
    d. Real power (kW): For each phase, 3-phase total.
    e. Reactive power (kVAR): For each phase, 3-phase total.
    f. Apparent power (kVA): For each phase, 3-phase total.
    g. Power factor.
    h. Real energy (kWh).
    i. Reactive energy (kVARh).
    j. Apparent energy (kVAh).
    k. Power demand: Real, reactive, and apparent.
3. Meter Accuracy: Plus/minus 1.0 percent.
4. Features:
    a. Communications Capability: Utilize Modbus communications protocol. Provide all accessories necessary for proper interface.
    b. KYZ pulse output.
    c. Adjustable demand interval.
    d. Remote monitoring capability via PC.

U. Instrument Transformers:

1. Comply with IEEE C57.13.
2. Select suitable ratio, burden, and accuracy as required for connected devices.

3. Current Transformers: Connect secondaries to shorting terminal blocks.
4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

2.3 OVERCURRENT PROTECTIVE DEVICES

A. Circuit Breakers:

1. Interrupting Capacity:
   a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
   b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
   c. Series Rated Systems: Provide circuit breakers listed in combination with upstream devices to provide interrupting rating not less than the short circuit current rating indicated.
2. Molded Case Circuit Breakers:
   a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
      1) Provide thermal magnetic circuit breakers for circuit breaker frame sizes less than 400 amperes.
      2) Provide electronic trip circuit breakers for circuit breaker frame sizes 400 amperes and above.
   b. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
      1) Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
   c. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
      1) Provide the following field-adjustable trip response settings:
         (a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
         (b) Long time delay.
         (c) Short time pickup and delay.
         (d) Instantaneous pickup.
         (e) Ground fault pickup and delay where ground fault protection is indicated.
      2) Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
      3) Provide communication capability where indicated: Compatible with system indicated.
   d. Provide the following circuit breaker types where indicated:
      1) 100 Percent Rated Circuit Breakers: Listed for application within the switchboard where installed at 100 percent of the continuous current rating.
      2) Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of

the symmetrical prospective current when operating within its current limiting range.

e. Provide the following features and accessories where indicated or where required to complete installation:
   1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
   2) Pad-Lock Provision: For locking circuit breaker handle in OFF position.

3. Insulated Case Circuit Breakers:
   a. Description: Quick-make, quick-break, trip-free circuit breakers with two-step stored energy closing mechanism; standard 80 percent rated unless otherwise indicated; listed and labeled as complying with UL 489; ratings, configurations, and features as indicated on the drawings.
   b. Operation:
      1) Provide manually operated circuit breakers unless otherwise indicated.
      2) Pad-Lock Provision: For preventing circuit breaker closing operation.
   c. Construction:
   d. Minimum Interrupting Capacity:
      1) 42,000 rms symmetrical amperes at 240 VAC or 208 VAC.
   e. Trip Units: Solid state, microprocessor-based, true rms sensing.
      1) Provide the following field-adjustable trip response settings:
         (a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
         (b) Long time delay.
         (c) Short time pickup and delay.
         (d) Instantaneous pickup.
         (e) Ground fault pickup and delay where ground fault protection is indicated.
      2) Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
      3) Provide communication capability where indicated: Compatible with system indicated.

   f. Provide the following circuit breaker types where indicated:
      1) 100 Percent Rated Circuit Breakers: Listed for application within the switchboard where installed at 100 percent of the continuous current rating.
      2) Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
   g. Provide the following features and accessories where indicated or where required to complete installation:
      1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.

2.4 SOURCE QUALITY CONTROL

A. See Section 01.4000 - Quality Requirements, for additional requirements.

B. Factory test switchboards according to NEMA PB 2, including the following production (routine) tests on each switchboard assembly or component:

1. Dielectric tests.
2. Mechanical operation tests.
3. Grounding of instrument transformer cases test.
4. Electrical operation and control wiring tests, including polarity and sequence tests.
5. Ground-fault sensing equipment test.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the switchboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive switchboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.

C. Arrange equipment to provide required clearances and maintenance access, including accommodations for any drawout devices.

D. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of 1/2 inch between switchboard and wall.

E. Provide required support and attachment in accordance with Section 26.0529.

F. Install switchboards plumb and level.

G. Unless otherwise indicated, mount switchboards on properly sized 4 inch high concrete pad constructed in accordance with Section 03.3000.

H. Provide grounding and bonding in accordance with Section 26.0526.

I. Install all field-installed devices, components, and accessories.

J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

K. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed in accordance with Section 26.0573.

L. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

M. Provide filler plates to cover unused spaces in switchboards.

3.3 FIELD QUALITY CONTROL

A. See Section 01.4000 - Quality Requirements, for additional requirements.

B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's reports with submittals.

C. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

D. Before energizing switchboard, perform insulation resistance testing in accordance with NECA 400 and NEMA PB 2.1.

E. Inspect and test in accordance with NETA ATS, except Section 4.

F. Perform inspections and tests listed in NETA ATS, Section 7.1.

G. Molded Case and Insulated Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than _____ amperes. Tests listed as optional are not required.

H. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.

I. Meters: Perform inspections and tests listed in NETA ATS, Section 7.11.2.

J. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10. The dielectric withstand tests on primary windings with secondary windings connected to ground listed as optional are not required.

K. Test shunt trips to verify proper operation.

L. Correct deficiencies and replace damaged or defective switchboards or associated components.

M. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of switchboard covers and doors.

3.5 CLEANING

A. See Section 01.7419 - Construction Waste Management and Disposal, for additional requirements.

B. Clean dirt and debris from switchboard enclosures and components according to manufacturer's instructions.

C. Repair scratched or marred surfaces to match original factory finish.

3.6 CLOSEOUT ACTIVITIES

A. See Section 01.7800 - Closeout Submittals, for closeout submittals.

B. See Section 01.7900 - Demonstration and Training, for additional requirements.

C. Training: Train Owner's personnel on operation, adjustment, and maintenance of switchboard and associated devices.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours of training.
3. Instructor: Manufacturer's authorized representative.
4. Location: At project site.

3.7 PROTECTION

A. Protect installed switchboards from subsequent construction operations.

END OF SECTION 26.2413

SECTION 26.2416 - PANELBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.2 RELATED REQUIREMENTS

A. Section 03.3000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 26.0526 - Grounding and Bonding for Electrical Systems.

C. Section 26.0529 - Hangers and Supports for Electrical Systems.

D. Section 26.0548 - Vibration and Seismic Controls for Electrical Systems.

E. Section 26.0553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 26.0573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

G. Section 26.2713 - Electricity Metering: For interface with equipment specified in this section.

H. Section 26.2813 - Fuses: Fuses for fusible switches and spare fuse cabinets.

I. Section 26.4300 - Surge Protective Devices.

1.3 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2025.

D. NEMA BS 31047 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013 (Reaffirmed 2023).

E. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

F. NEMA PB 1 - Panelboards; 2011.

G. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 1000V or Less; 2023.

H. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

K. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

L. UL 67 - Panelboards; Current Edition, Including All Revisions.

M. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

N. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

O. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

P. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

Q. UL 1699 - Arc-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 01.3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.

C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
2. Include wiring diagrams showing all factory and field connections.
3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
4. Include documentation of listed series ratings upon request.
5. Identify mounting conditions required for equipment seismic qualification.

D. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.

E. Field Quality Control Test Reports.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01.6000 - Product Requirements, for additional provisions.
2. Panelboard Keys: Two of each different key.
3. See Section 26.2813 for requirements for spare fuses and spare fuse cabinets.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain ambient temperature within the following limits during and after installation of panelboards:

1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
2. Panelboards Containing Fusible Switches: Between -22 degrees F and 104 degrees F.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB: www.electrification.us.abb.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric: www.se.com/#sle.

D. Siemens Industry, Inc: www.new.siemens.com/#sle.

E. Substitutions: See Section 01.6000 - Product Requirements.

F. Source Limitations: Provide panelboards and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from a single supplier.

2.2 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:

1. Altitude: Less than 6,600 feet.
2. Ambient Temperature:
   a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
   b. Panelboards Containing Fusible Switches: Between -22 degrees F and 104 degrees F.

C. Short Circuit Current Rating:

1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
2. Listed series ratings are acceptable, except where not permitted by motor contribution according to NFPA 70.
3. Label equipment utilizing series ratings as required by NFPA 70.

D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

F. Bussing: Sized in accordance with UL 67 temperature rise requirements.

1. Provide fully rated neutral bus, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
2. Provide 200 percent rated neutral bus and lugs where indicated, where oversized neutral conductors are provided, or where panelboards are fed from K-rated transformers.
3. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor Clean, Dry Locations: Type 1.
   b. Outdoor Locations: Type 3R.
2. Boxes: Galvanized steel unless otherwise indicated.
   a. Provide wiring gutters sized to accommodate the conductors to be installed.
   b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.

c. Provide removable end walls for NEMA Type 1 enclosures.
d. Provide painted steel boxes for surface-mounted panelboards where indicated, finish to match fronts.

3. Fronts:
   a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
   b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
   c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
4. Lockable Doors: All locks keyed alike unless otherwise indicated.

I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

J. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.

1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
   a. Use zero sequence ground fault detection method unless otherwise indicated.
   b. Provide test panel and field-adjustable ground fault pick-up and delay settings.
   c. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control ground fault delay functions for system coordination purposes.

K. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

L. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.

M. Load centers are not acceptable.

N. Provide the following features and accessories where indicated or where required to complete installation:

1. Feed-through lugs.
2. Sub-feed lugs.

2.3 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:

1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
2. Main and Neutral Lug Type: Mechanical.

C. Bussing:

1. Phase and Neutral Bus Material: Copper.
2. Ground Bus Material: Copper.

D. Circuit Breakers:

1. Provide bolt-on type.
2. Provide thermal magnetic circuit breakers unless otherwise indicated.
3. Provide electronic trip circuit breakers for circuit breaker frame sizes 400 amperes and above.

E. Enclosures:

1. Provide surface-mounted enclosures unless otherwise indicated.
2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide clear plastic circuit directory holder mounted on inside of door.

2.4 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:

1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
2. Main and Neutral Lug Type: Mechanical.

C. Bussing:

1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
2. Phase and Neutral Bus Material: Copper.
3. Ground Bus Material: Copper.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:

1. Provide surface-mounted or flush-mounted enclosures as indicated.
2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide clear plastic circuit directory holder mounted on inside of door.

2.5 OVERCURRENT PROTECTIVE DEVICES

A. Fusible Switches:

1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA BS 31047, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
2. Fuse Clips: As required to accept indicated fuses.
   a. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.
3. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the

cover with the switch in the ON position with capability of overriding interlock for testing purposes.

4. Conductor Terminations:
   a. Provide mechanical lugs unless otherwise indicated.
   b. Provide compression lugs where indicated.
   c. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

B. Molded Case Circuit Breakers:

1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
2. Interrupting Capacity:
   a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
      1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
   b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
   c. Series Rated Systems: Provide circuit breakers listed in combination with upstream devices to provide interrupting rating not less than the short circuit current rating indicated.
3. Conductor Terminations:
   a. Provide mechanical lugs unless otherwise indicated.
   b. Provide compression lugs where indicated.
   c. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
   a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
   a. Provide the following field-adjustable trip response settings:
      1) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
      2) Long time delay.
      3) Short time pickup and delay.
      4) Instantaneous pickup.
      5) Ground fault pickup and delay where ground fault protection is indicated.
   b. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
   c. Provide communication capability where indicated: Compatible with system indicated.
6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
7. Provide the following circuit breaker types where indicated:

a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.
d. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
e. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.

8. Do not use tandem circuit breakers.
9. Do not use handle ties in lieu of multi-pole circuit breakers.
10. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
11. Provide the following features and accessories where indicated or where required to complete installation:
    a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.

2.6 SOURCE QUALITY CONTROL

A. See Section 01.4000 - Quality Requirements, for additional requirements.

B. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required support and attachment in accordance with Section 26.0529.

F. Install panelboards plumb.

G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

I. Mount floor-mounted power distribution panelboards on properly sized 4 inch high concrete pad constructed in accordance with Section 03.3000.

J. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

K. Provide grounding and bonding in accordance with Section 26.0526.

1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.

L. Install all field-installed branch devices, components, and accessories.

M. Provide fuses complying with Section 26.2813 for fusible switches as indicated.

N. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

O. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.

P. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 26.0573.

Q. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

R. Provide filler plates to cover unused spaces in panelboards.

S. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:

1. Emergency and night lighting circuits.
2. Fire detection and alarm circuits.
3. Communications equipment circuits.
4. Intrusion detection and access control system circuits.
5. Video surveillance system circuits.

T. Identify panelboards in accordance with Section 26.0553.

3.3 FIELD QUALITY CONTROL

A. See Section 01.4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than _____ amperes. Tests listed as optional are not required.

E. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.

F. Test GFCI circuit breakers to verify proper operation.

G. Test AFCI circuit breakers to verify proper operation.

H. Test shunt trips to verify proper operation.

I. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

J. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.5 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26.2416

SECTION 26.2713 - ELECTRICITY METERING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Equipment for Owner electricity metering:

1. Single circuit electricity meters.
2. Multi-circuit electricity meters.

1.2 RELATED REQUIREMENTS

A. Section 26.0526 - Grounding and Bonding for Electrical Systems.

B. Section 26.0529 - Hangers and Supports for Electrical Systems.

C. Section 26.0533.16 - Boxes for Electrical Systems: Cabinets and enclosures for metering system components.

D. Section 26.0553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26.2100 - Low-Voltage Electrical Service Entrance: Requirements for Utility Company electricity metering.

F. Section 26.2413 - Switchboards: For interface with meters specified in this section.

G. Section 26.2416 - Panelboards: For interface with meters specified in this section.

H. Section 26.2813 - Fuses.

I. Section 27.1000 - Structured Cabling: Data cables for IP network connections.

1.3 REFERENCE STANDARDS

A. ANSI C12.1 - Electric Meters - Code for Electricity Metering; 2026.

B. IEC 62053-21 - Electricity Metering Equipment - Particular Requirements - Part 21: Static Meters for AC Active Energy (Classes 0,5, 1 and 2); 2020.

C. IEC 62053-23 - Electricity Metering Equipment - Particular Requirements - Part 23: Static Meters for Reactive Energy (Classes 2 and 3); 2020.

D. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2016.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

F. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

G. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate work to provide equipment suitable for interface with electricity metering systems to be provided.
2. Coordinate the work with other installers to provide communication lines required for electricity metering system interface.
3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Preinstallation Meeting: Conduct meeting with facility representative and other related equipment manufacturers to discuss electricity metering system interface requirements.

1.5 SUBMITTALS

A. See Section 01.3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for electricity metering systems and associated components and accessories. Include ratings, configurations, standard wiring diagrams, dimensions, service condition requirements, and installed features.

C. Shop Drawings: Include system interconnection schematic diagrams showing all factory and field connections. Include requirements for interface with other systems.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Field Quality Control Test Reports.

F. Project Record Documents: Record actual installed locations of meters and final equipment settings.

G. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01.6000 - Product Requirements, for additional provisions.
2. Enclosure Keys: Two of each different key.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.8 FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Electricity Meters:

1. ABB: www.electrification.us.abb.com/#sle.
2. DENT Instruments; PowerScout FLEX 3 Power Submeter: www.dentinstruments.com/#sle.
3. Eaton Corporation: www.eaton.com/#sle.
4. Schneider Electric: www.se.com/#sle.
5. Siemens Industry, Inc: www.new.siemens.com/#sle.
6. SOCOMEC: www.socomec.us/#sle.
7. Veris Industries: www.veris.com/#sle.
8. Leviton.
9. Substitutions: See Section 01.6000 - Product Requirements.
10. Source Limitations: Provide electricity meters produced by single manufacturer and obtained from single supplier.

2.2 EQUIPMENT FOR OWNER ELECTRICITY METERING

A. Provide microprocessor-based digital electricity metering systems including all instrument transformers, wiring, and connections necessary for measurements specified.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Provide electricity metering systems and associated components compatible with the equipment and associated circuits to be metered.

D. Service Conditions: Provide electricity meters suitable for operation under the service conditions at the installed location.

E. Enclosures:

1. Where not furnished by manufacturer, provide required cabinets and enclosures in accordance with Section 26.0533.16.
2. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor Clean, Dry Locations: Type 1.
   b. Outdoor Locations: Type 3R or Type 4.
3. Provide lockable door(s) for outdoor locations.
4. Finish: Manufacturer's standard unless otherwise indicated.

F. Instrument Transformers:

1. Comply with IEEE C57.13, where applicable.
2. Select suitable ratio, burden, and accuracy as required for connected devices.

3. Current Transformers: Compatible with connected meters; replace meters damaged by connection of incompatible current transformers. Provide shorting terminal blocks for connection of secondaries where applicable.
4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

G. Accessories:

1. Wiring: Provide manufacturer's recommended cables as indicated or as required for connections between system components.

2.3 SINGLE CIRCUIT ELECTRICITY METERS

A. Single Circuit Electricity Meter:

1. Accuracy:
   a. Real/Active Power/Energy: Revenue grade; plus/minus 1.0 percent; complying with ANSI C12.1 and/or IEC 62053-21 Class 1.
   b. Reactive Power/Energy: Plus/minus 2.0 percent, complying with IEC 62053-23 Class 2.
2. Measured Parameters:
   a. Voltage (Volts AC); line-to-line and line-to-neutral; per phase.
   b. Current (Amps); per phase.
   c. Frequency (Hz).
   d. Real/active power (kW); per phase and total of all phases.
   e. Reactive power (kVAR); per phase and total of all phases.
   f. Apparent power (kVA); per phase and total of all phases.
   g. Power factor; per phase and total of all phases.
   h. Real/active energy (kWh).
   i. Reactive energy (kVARh).
   j. Apparent energy (kVAh).
   k. Power demand; real/active, reactive, and apparent; present and maximum.
   l. Current demand.
   m. Bi-directional energy measurements; real/active and reactive; imported and exported.
3. Data logging.
   a. Storage Capacity: 30 days of readings at 15 minute intervals.
4. Alarm capability, with configurable setpoints.
   a. Current over range.
   b. Voltage over range.
5. Inputs:
6. Outputs:
   a. Pulse Output(s): One.
7. Communications: Compatible with connected systems. Provide all accessories necessary for proper interface.
   a. Serial Communications: RS-485; support for Modbus RTU protocol.
   b. Ethernet Communications: Support for Modbus TCP protocol.

2.4 MULTI-CIRCUIT ELECTRICITY METERS

A. Multi-Circuit Electricity Meter:

1. Metering Capacity: As indicated or as required for circuits to be metered.
2. Accuracy:

a. Real/Active Power/Energy: Revenue grade; plus/minus 1.0 percent; complying with ANSI C12.1 and/or IEC 62053-21 Class 1.
b. Reactive Power/Energy: Plus/minus 2.0 percent, complying with IEC 62053-23 Class 2.

3. Measured Parameters:
   a. Voltage (Volts AC); line-to-line and line-to-neutral; per phase.
   b. Current (Amps); per phase.
   c. Frequency (Hz).
   d. Real/active power (kW); per phase and total of all phases.
   e. Reactive power (kVAR); per phase and total of all phases.
   f. Apparent power (kVA); per phase and total of all phases.
   g. Power factor; per phase and total of all phases.
   h. Real/active energy (kWh).
   i. Reactive energy (kVARh).
   j. Apparent energy (kVAh).
   k. Power demand; real/active; present and maximum.
4. Data logging.
   a. Storage Capacity: 30 days of readings at 15 minute intervals.
5. Alarm capability, with configurable setpoints.
   a. Current over range.
   b. Voltage over range.
6. Inputs:
7. Outputs:
8. Communications: Compatible with connected systems. Provide all accessories necessary for proper interface.
   a. Serial Communications: RS-485; support for Modbus RTU protocol.
   b. Ethernet Communications: Support for Modbus TCP protocol.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of metering systems and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive meters.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Provide required support and attachment components in accordance with Section 26.0529.

D. Provide grounding and bonding in accordance with Section 26.0526.

E. Provide fuses complying with Section 26.2813 as required.

F. Identify meters and associated wiring in accordance with Section 26.0553.

3.3 FIELD QUALITY CONTROL

A. See Section 01.4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Meters: Perform inspections and tests listed in NETA ATS, Section 7.11.2.

D. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10. The dielectric withstand tests on primary windings with secondary windings connected to ground listed as optional are not required.

E. Correct deficiencies and replace damaged or defective metering system components.

F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.4 ADJUSTING

A. Program system parameters according to requirements of Owner.

3.5 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.6 CLOSEOUT ACTIVITIES

A. See Section 01.7800 - Closeout Submittals, for closeout submittals.

B. See Section 01.7900 - Demonstration and Training, for additional requirements.

C. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours of training.
3. Instructor: Manufacturer's authorized representative.
4. Location: At project site.

3.7 PROTECTION

A. Protect installed system components from subsequent construction operations.

END OF SECTION 26.2713

SECTION 26.2726 - WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall switches.

B. Wall dimmers.

C. Receptacles.

D. Wall plates and covers.

E. Floor box service fittings.

F. Poke-through assemblies.

1.2 RELATED REQUIREMENTS

A. Section 26.0519 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.

B. Section 26.0526 - Grounding and Bonding for Electrical Systems.

C. Section 26.0533.16 - Boxes for Electrical Systems.

D. Section 26.0533.23 - Surface Raceways for Electrical Systems: Surface raceway systems, including multioutlet assemblies.

E. Section 26.0553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 26.0583 - Wiring Connections: Cords and plugs for equipment.

G. Section 26.0923 - Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors, in-wall time switches, and in-wall interval timers.

H. Section 27.1000 - Structured Cabling: Voice and data jacks.

1.3 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2014h (Validated 2022).

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification); 2017g (Validated 2023).

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

K. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

L. UL 1310 - Class 2 Power Units; Current Edition, Including All Revisions.

M. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

N. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
3. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
4. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:

1. Do not install wiring devices until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. See Section 01.3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1. Wall Dimmers: Include derating information for ganged multiple devices.
2. Surge Protection Receptacles: Include surge current rating, voltage protection rating (VPR) for each protection mode, and diagnostics information.

C. Samples: One for each type and color of device and wall plate specified.

D. Certificates for Surge Protection Receptacles: Manufacturer's documentation of listing for compliance with UL 1449.

E. Field Quality Control Test Reports.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Operation and Maintenance Data:

1. Wall Dimmers: Include information on operation and setting of presets.
2. GFCI Receptacles: Include information on status indicators.

3. Surge Protection Receptacles: Include information on status indicators.

H. Project Record Documents: Record actual installed locations of wiring devices.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01.6000 - Product Requirements, for additional provisions.
2. Screwdrivers for Tamper-Resistant Screws: Two for each type of screw.
3. Extra Keys for Locking Switches: Two of each type.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Products: Listed, classified, and labeled as suitable for the purpose intended.

E. Product Evaluation and Listing Organization Qualifications: Organization engaged in evaluation of products and services, including those recognized by OSHA as Nationally Recognized Testing Laboratories (NRTL), and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.1 WIRING DEVICES - GENERAL REQUIREMENTS

A. Provide wiring devices suitable for intended use with ratings adequate for load served.

B. Except where explicitly permitted, substitution of combination switch-and-receptacle devices for separate switches and receptacles is not permitted.

C. Prewired Wiring Device and Outlet Box Assemblies: Factory-assembled products complying with requirements for wiring devices, boxes, and wiring methods may be used in lieu of field-assembled products.

1. Wiring: See Section 26.0519 - Low-Voltage Electrical Power Conductors and Cables.
2. Boxes: See Section 26.0533.16 - Boxes for Electrical Systems.

D. Wiring Device Applications:

1. Receptacles Installed Outdoors or in Damp or Wet Locations: Use weather-resistant GFCI receptacles with weatherproof covers.
2. Provide GFCI protection for:
   a. Receptacles installed within 6 feet of sinks.
   b. Receptacles installed in kitchens.
3. Single Receptacles Installed on Individual Branch Circuits: Provide receptacle ampere rating equal to branch circuit rating.

E. Wiring Device Finishes:

1. Provide wiring device finishes as described below, unless otherwise indicated.
2. Wiring Devices, Unless Otherwise Indicated: White with stainless steel wall plate.
3. Surge Protection Receptacles: Blue.
4. Wiring Devices Connected to Emergency Power: Red with red nylon wall plate.

2.2 WALL SWITCHES

A. Manufacturers:

1. Leviton Manufacturing Company, Inc; _____: www.leviton.com/#sle.
2. Pass & Seymour, a brand of Legrand North America, Inc; _____: www.legrand.us/#sle.
3. Substitutions: See Section 01.6000 - Product Requirements.

B. General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.

1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

C. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

D. Locking Wall Switches: Industrial specification grade, 20 A, 120/277 V with lever type keyed switch actuator and maintained contacts; switches keyed alike; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.3 WALL DIMMERS

A. Manufacturers:

1. Leviton Manufacturing Company, Inc; _____: www.leviton.com/#sle.
2. Lutron Electronics Company, Inc; Maestro Series: www.lutron.com/#sle.
3. Pass & Seymour, a brand of Legrand North America, Inc; _____: www.legrand.us/#sle.
4. Substitutions: See Section 01.6000 - Product Requirements.

B. General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

C. Control: Slide control type with separate on/off switch.

D. Power Rating, Unless Otherwise Indicated or Required to Control the Load Indicated on the Drawings:

2.4 RECEPTACLES

A. Manufacturers:

1. Hubbell Incorporated; _____: www.hubbell.com/#sle.
2. Leviton Manufacturing Company, Inc; _____: www.leviton.com/#sle.
3. Lutron Electronics Company, Inc; Designer Style: www.lutron.com/#sle.
4. Pass & Seymour, a brand of Legrand North America, Inc; _____: www.legrand.us/#sle.
5. Substitutions: See Section 01.6000 - Product Requirements.

6. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.

B. General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.

1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
2. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:

1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
2. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
3. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
4. Tamper Resistant and Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

D. GFCI Receptacles:

1. General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
   a. Provide test and reset buttons of same color as device.
2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.
4. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.
5. Tamper Resistant and Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.

E. USB Charging Devices:

1. General Requirements: Listed as complying with UL 1310.
   a. Charging Capacity - Two-Port Devices: 2.1 A, minimum.
   b. Charging Capacity - Four-Port Devices: 4.2 A, minimum.
2. USB Charging/Tamper Resistant Receptacle Combination Devices: Two-port (Type A and Type C) USB charging device and receptacle, commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; rectangular decorator style.

F. Locking Receptacles: Industrial specification grade, configuration as indicated on the drawings.

2.5 WALL PLATES AND COVERS

A. Manufacturers:

1. Hubbell Incorporated; _____: www.hubbell-wiring.com/#sle.
2. Intermatic, Inc; _____: www.intermatic.com/#sle.
3. Leviton Manufacturing Company, Inc; _____: www.leviton.com/#sle.
4. Lutron Electronics Company, Inc; _____: www.lutron.com/#sle.
5. Pass & Seymour, a brand of Legrand North America, Inc; _____: www.legrand.us/#sle.

B. Wall Plates: Comply with UL 514D.

1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
2. Size: Standard; _____.
3. Screws: Metal with slotted heads finished to match wall plate finish.

C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

D. Weatherproof Receptacle Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.

E. Weatherproof Receptacle Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

2.6 POKE-THROUGH ASSEMBLIES

A. Manufacturers:

1. Hubbell Incorporated; _____: www.hubbell.com/#sle.
2. Thomas & Betts Corporation; _____: www.tnb.com/#sle.
3. Wiremold, a brand of Legrand North America, Inc; _____: www.legrand.us/#sle.
4. Substitutions: See Section 01.6000 - Product Requirements.

B. Description: Assembly comprising floor service fitting, poke-through component, fire stops and smoke barriers, and junction box for conduit termination; fire rating listed to match fire rating of floor and suitable for floor thickness where installed.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that floor boxes are adjusted properly.

F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

G. Verify that core drilled holes for poke-through assemblies are in proper locations.

H. Verify that openings in access floor are in proper locations.

I. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26.0533.16 as required for installation of wiring devices provided under this section.

1. Mounting Heights: Unless otherwise indicated, as follows:
   a. Wall Switches: 48 inches above finished floor.
   b. Wall Dimmers: 48 inches above finished floor.
   c. Fan Speed Controllers: 48 inches above finished floor.
   d. Receptacles: 18 inches above finished floor or 6 inches above counter.
2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

I. Install wiring devices plumb and level with mounting yoke held rigidly in place.

J. Install wall switches with OFF position down.

K. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

L. Do not share neutral conductor on branch circuits utilizing wall dimmers.

M. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

N. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

O. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

P. Identify wiring devices in accordance with Section 26.0553.

Q. Install poke-through closure plugs in each unused core holes to maintain fire rating of floor.

3.4 FIELD QUALITY CONTROL

A. See Section 01.4000 - Quality Requirements, for additional requirements.

B. Inspect each wiring device for damage and defects.

C. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.

D. Test each receptacle to verify operation and proper polarity.

E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.5 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Architect.

3.6 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION 26.2726

SECTION 26.2813 - FUSES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fuses.

B. Spare fuse cabinet.

1.2 RELATED REQUIREMENTS

A. Section 26.0553 - Identification for Electrical Systems: Identification products and requirements.

B. Section 26.0573 - Power System Studies: Additional criteria for the selection of protective devices specified in this section.

C. Section 26.2413 - Switchboards: Fusible switches.

D. Section 26.2416 - Panelboards: Fusible switches.

E. Section 26.2816.16 - Enclosed Switches: Fusible switches.

1.3 REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.

D. UL 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses; Current Edition, Including All Revisions.

E. UL 248-8 - Low-Voltage Fuses - Part 8: Class J Fuses; Current Edition, Including All Revisions.

F. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses; Current Edition, Including All Revisions.

G. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

H. UL 248-15 - Low-Voltage Fuses - Part 15: Class T Fuses; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
    a. Fusible Switches for Switchboards: See Section 26.2413.
    b. Fusible Enclosed Switches: See Section 26.2816.16.
2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 01.3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.

1. Spare Fuse Cabinet: Include dimensions.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01.6000 - Product Requirements, for additional provisions.
2. Extra Fuses: One set(s) of three for each type and size installed.
3. Fuse Pullers: One set(s) compatible with each type and size installed.
4. Spare Fuse Cabinet Keys: Two.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Bussmann, a division of Eaton Corporation; _____: www.cooperindustries.com/#sle.

B. Littelfuse, Inc; _____: www.littelfuse.com/#sle.

C. Mersen; _____: ep-us.mersen.com/#sle.

D. Substitutions: See Section 01.6000 - Product Requirements.

2.2 APPLICATIONS

A. Service Entrance:

1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.

B. Feeders:

1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.

C. General Purpose Branch Circuits: Class RK1, time-delay.

D. Individual Motor Branch Circuits: Class RK1, time-delay.

E. In-Line Protection for Pole-Mounted Luminaires: Class CC, time-delay.

F. Primary Protection for Control Transformers: Class CC, time-delay.

2.3 FUSES

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

D. Comply with UL 248-1.

E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.

F. Voltage Rating: Suitable for circuit voltage.

G. Class R Fuses: Comply with UL 248-12.

H. Class J Fuses: Comply with UL 248-8.

I. Class L Fuses: Comply with UL 248-10.

J. Class T Fuses: Comply with UL 248-15.

K. Class CC Fuses: Comply with UL 248-4.

L. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

M. Provide the following accessories where indicated or where required to complete installation:

1. Fuse Reducers: For adapting indicated fuses to permit installation in switch designed for fuses with larger ampere ratings.

2.4 SPARE FUSE CABINET

A. Description: Wall-mounted sheet metal cabinet with shelves and hinged door with cylinder lock, suitably sized to store spare fuses and fuse pullers specified.

B. Finish: Manufacturer's standard, factory applied grey finish unless otherwise indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B. Verify that mounting surfaces are ready to receive spare fuse cabinet.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

C. Install spare fuse cabinet where indicated.

D. Identify spare fuse cabinet in accordance with Section 26.0553.

END OF SECTION 26.2813

SECTION 26.2816.13 - ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Enclosed circuit breakers.

1.2 RELATED REQUIREMENTS

A. Section 26.0526 - Grounding and Bonding for Electrical Systems.

B. Section 26.0529 - Hangers and Supports for Electrical Systems.

C. Section 26.0548 - Vibration and Seismic Controls for Electrical Systems.

D. Section 26.0553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26.0573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

1.3 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

I. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

J. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

K. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted enclosed circuit breakers where indicated.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 01.3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for circuit breakers, enclosures, and other installed components and accessories.

1. Include characteristic trip curves for each type and rating of circuit breaker upon request.

C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Include dimensioned plan and elevation views of enclosed circuit breakers and adjacent equipment with all required clearances indicated.
2. Include wiring diagrams showing all factory and field connections.
3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
4. Include documentation of listed series ratings upon request.
5. Identify mounting conditions required for equipment seismic qualification.

D. Manufacturer's equipment seismic qualification certification.

E. Field Quality Control Test Reports.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

G. Project Record Documents: Record actual installed locations of enclosed circuit breakers.

H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed circuit breaker internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain ambient temperature between 23 degrees F and 104 degrees F during and after installation of enclosed circuit breakers.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB: www.electrification.us.abb.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric: www.se.com/#sle.

D. Siemens Industry, Inc: www.new.siemens.com/#sle.

E. Substitutions: See Section 01.6000 - Product Requirements.

F. Source Limitations: Provide enclosed circuit breakers and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from single supplier.

2.2 ENCLOSED CIRCUIT BREAKERS

A. Description: Units consisting of molded case circuit breakers individually mounted in enclosures.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:

1. Altitude: Less than 6,600 feet.
2. Ambient Temperature: Between 23 degrees F and 104 degrees F.

D. Short Circuit Current Rating:

1. Provide enclosed circuit breakers with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26.0573.
2. Listed series ratings are acceptable, except where not permitted by motor contribution according to NFPA 70.
3. Label equipment utilizing series ratings as required by NFPA 70.

E. Enclosed Circuit Breakers Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

F. Conductor Terminations: Suitable for use with the conductors to be installed.

G. Provide thermal magnetic circuit breakers unless otherwise indicated.

H. Provide electronic trip circuit breakers for circuit breaker frame sizes 400 amperes and above.

I. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

J. Provide solidly bonded equipment ground bus in each enclosed circuit breaker, with a suitable lug for terminating each equipment grounding conductor.

K. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor Clean, Dry Locations: Type 1.
2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.
3. Provide surface-mounted enclosures unless otherwise indicated.

L. Provide externally operable handle with means for locking in the OFF position.

M. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.

1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
2. Where accessory ground fault sensing and relaying equipment is used, equip companion circuit breakers with ground-fault shunt trips.
   a. Use zero sequence ground fault detection method unless otherwise indicated.
   b. Provide test panel and field-adjustable ground fault pick-up and delay settings.
   c. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control ground fault delay functions for system coordination purposes.

N. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

2.3 MOLDED CASE CIRCUIT BREAKERS

A. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.

B. Interrupting Capacity:

1. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
   a. 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
2. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
3. Series Rated Systems: Provide circuit breakers listed in combination with upstream devices to provide interrupting rating not less than the short circuit current rating indicated.

C. Conductor Terminations:

1. Provide mechanical lugs unless otherwise indicated.
2. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

D. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.

1. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.

E. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.

1. Provide the following field-adjustable trip response settings:
   a. Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
   b. Long time delay.
   c. Short time pickup and delay.
   d. Instantaneous pickup.
   e. Ground fault pickup and delay where ground fault protection is indicated.
2. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.

F. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

G. Provide the following circuit breaker types where indicated:

1. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
2. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.

H. Provide the following features and accessories where indicated or where required to complete installation:

1. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
2. Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
3. Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
4. Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed circuit breakers are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed circuit breakers.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 26.0529.

E. Install enclosed circuit breakers plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed circuit breakers such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26.0526.

H. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

I. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 26.0573.

J. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

K. Identify enclosed circuit breakers in accordance with Section 26.0553.

3.3 FIELD QUALITY CONTROL

A. See Section 01.4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with manufacturer's instructions and NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for circuit breakers used for service entrance. Tests listed as optional are not required.

D. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

E. Test GFCI circuit breakers to verify proper operation.

F. Test shunt trips to verify proper operation.

G. Correct deficiencies and replace damaged or defective enclosed circuit breakers.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5 CLEANING

A. Clean dirt and debris from circuit breaker enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26.2816.13

SECTION 26.2816.16 - ENCLOSED SWITCHES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Enclosed safety switches.

B. Enclosed fused power-circuit devices.

1.2 RELATED REQUIREMENTS

A. Section 26.0526 - Grounding and Bonding for Electrical Systems.

B. Section 26.0529 - Hangers and Supports for Electrical Systems.

C. Section 26.0548 - Vibration and Seismic Controls for Electrical Systems.

D. Section 26.0553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26.2813 - Fuses.

F. Section 26.3600 - Transfer Switches: Automatic and non-automatic switches listed for use as transfer switch equipment.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NEMA BS 31047 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013 (Reaffirmed 2023).

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 01.3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Include dimensioned plan and elevation views of enclosed switches and adjacent equipment with all required clearances indicated.
2. Include wiring diagrams showing all factory and field connections.
3. Identify mounting conditions required for equipment seismic qualification.

D. Manufacturer's equipment seismic qualification certification.

E. Field Quality Control Test Reports.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

G. Project Record Documents: Record actual locations of enclosed switches.

H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01.6000 - Product Requirements, for additional provisions.
2. See Section 26.2813 for requirements for spare fuses and spare fuse cabinets.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain ambient temperature between -22 degrees F and 104 degrees F during and after installation of enclosed switches.

PART 2 PRODUCTS

2.1 ENCLOSED SAFETY SWITCHES

A. Manufacturers:

1. ABB: www.electrification.us.abb.com/#sle.
2. Eaton Corporation: www.eaton.com/#sle.
3. Schneider Electric: www.se.com/#sle.
4. Siemens Industry, Inc: www.siemens.com/#sle.
5. Substitutions: See Section 01.6000 - Product Requirements.
6. Source Limitations: Furnish products produced by same manufacturer as other electrical distribution equipment for project and obtained from single supplier.

B. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:

1. Altitude: Less than 6,600 feet.
2. Ambient Temperature: Between -22 degrees F and 104 degrees F.

E. Horsepower Rating: Suitable for connected load.

F. Voltage Rating: Suitable for circuit voltage.

G. Short Circuit Current Rating:

1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
2. Minimum Ratings:
   a. Switches Protected by Class H Fuses: 10,000 rms symmetrical amperes.
   b. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.

H. Provide with switch blade contact position that is visible when the cover is open.

I. Fuse Clips for Fusible Switches: As required to accept fuses indicated.

1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

J. Conductor Terminations: Suitable for use with the conductors to be installed.

K. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

L. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

M. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor Clean, Dry Locations: Type 1.
   b. Outdoor Locations: Type 3R.
2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.

N. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

O. Heavy Duty Switches:

1. Comply with NEMA BS 31047.
2. Conductor Terminations:
   a. Provide mechanical lugs unless otherwise indicated.
   b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 26.0529.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26.0526.

H. Provide fuses complying with Section 26.2813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

J. Identify enclosed switches in accordance with Section 26.0553.

3.3 FIELD QUALITY CONTROL

A. See Section 01.4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26.2816.16

SECTION 26.3213 - ENGINE GENERATORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Packaged engine generator system and associated components and accessories:

1. Engine and engine accessory equipment.
2. Alternator (generator).
3. Generator set control system.
4. Generator set enclosure.

1.2 RELATED REQUIREMENTS

A. Section 03.3000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 23.1123 - Facility Natural-Gas Piping.

C. Section 23.5100 - Breechings, Chimneys, and Stacks: Engine exhaust piping.

1. Includes installation of exhaust silencer specified in this section.

D. Section 26.0526 - Grounding and Bonding for Electrical Systems.

E. Section 26.0529 - Hangers and Supports for Electrical Systems.

F. Section 26.0548 - Vibration and Seismic Controls for Electrical Systems.

G. Section 26.0553 - Identification for Electrical Systems: Identification products and requirements.

H. Section 26.3600 - Transfer Switches.

I. Section 26.3633 - Connection Cabinets for Portable Generators and Load Banks.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA/EGSA 404 - Standard for Installing Generator Sets; 2014.

C. NEMA MG 00001 - Motors and Generators; 2024.

D. NFPA 30 - Flammable and Combustible Liquids Code; 2027, with Errata (2026).

E. NFPA 37 - Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines; 2024, with Amendment.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. NFPA 99 - Health Care Facilities Code; 2027.

H. NFPA 110 - Standard for Emergency and Standby Power Systems; 2025.

I. UL 1236 - Battery Chargers for Charging Engine-Starter Batteries; Current Edition, Including All Revisions.

J. UL 2200 - Stationary Engine Generator Assemblies; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate compatibility of generator sets to be installed with work provided under other sections or by others.
   a. Transfer Switches: See Section 26.3600.
2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment or other potential obstructions within the spaces dedicated for engine generator system.
3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.
4. Coordinate the work to provide electrical circuits suitable for the power requirements of the actual auxiliary equipment and accessories to be installed.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Preinstallation Meeting: Convene one week before starting work of this section; require attendance of all affected installers.

1.5 SUBMITTALS

A. See Section 01.3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features. Include alternator starting capabilities, engine fuel consumption rates, and cooling, combustion air, and exhaust requirements.

1. Include generator set sound level test data.
2. Include characteristic trip curves for overcurrent protective devices.
3. Include alternator thermal damage curve.

C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing all factory and field connections.

1. Identify mounting conditions required for equipment seismic qualification.

D. Manufacturer's equipment seismic qualification certification.

E. Derating Calculations: Indicate ratings adjusted for applicable service conditions.

F. Fuel Storage Tank Calculations: Indicate maximum running time for generator set configuration provided.

G. Evidence of qualifications for installer.

H. Evidence of qualifications for maintenance contractor (if different entity from installer).

I. Evidence of manufacturer approval for use of flexible reusable and removable blanket insulation for engine.

J. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

K. Manufacturer's factory emissions certification.

L. Manufacturer's certification that products meet or exceed specified requirements.

M. Source quality control test reports.

N. Provide NFPA 110 required documentation from manufacturer where requested by authorities having jurisdiction, including but not limited to:

1. Certified prototype tests.
2. Torsional vibration compatibility certification.
3. NFPA 110 compliance certification.
4. Certified rated load test at rated power factor.

O. Manufacturer's detailed field testing procedures.

P. Field quality control test reports.

Q. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.

R. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.

S. Maintenance contracts.

T. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

U. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01.6000 - Product Requirements, for additional provisions.
2. Extra Fuses: One of each type and size.
3. Extra Filter Elements: One of each type, including fuel, oil and air.

1.6 QUALITY ASSURANCE

A. Comply with the following:

1. NFPA 70 (National Electrical Code).
2. NFPA 110 (Standard for Emergency and Standby Power Systems); meet requirements for Level 1 system.
3. NFPA 37 (Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines).
4. NFPA 30 (Flammable and Combustible Liquids Code).

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1. Authorized service facilities located within 200 miles of project site.

D. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with engine generator systems of similar size, type, and complexity; manufacturer's authorized installer.

E. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

1. Contract maintenance office located within 200 miles of project site.

F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store generator sets in accordance with manufacturer's instructions and NECA/EGSA 404.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's instructions to avoid damage to generator set components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

A. See Section 01.7800 - Closeout Submittals, for additional warranty requirements.

B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Packaged Engine Generator Set:

1. Caterpillar Inc: www.cat.com/#sle.
2. Cummins Power Generation Inc: www.cumminspower.com/#sle.
3. Rehlko: www.powersystems.rehlko.com/#sle.
4. Rolls-Royce Power Systems; MTU: www.mtu-solutions.com/#sle.

B. Substitutions: See Section 01.6000 - Product Requirements.

C. Source Limitations: Furnish engine generator sets and associated components and accessories produced by single manufacturer and obtained from single supplier.

2.2 PACKAGED ENGINE GENERATOR SYSTEM

A. Provide new engine generator system consisting of all required equipment, sensors, conduit, boxes, wiring, piping, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. System Description:

1. Application: Emergency/standby.
2. Configuration: Multiple packaged engine generator sets operated in parallel.
3. Total System Power Rating: As indicated on drawings, standby.
4. Where design is based on multiple parallel generator sets, use of fewer, larger unit(s) to obtain equivalent total system power rating is not permitted.

D. Packaged Engine Generator Set:

1. Type: Gaseous (spark ignition).
2. Power Rating: As indicated on drawings, standby.
3. Voltage: As indicated on drawings.
4. Main Line Circuit Breaker:
    a. Type: Electronic trip with long time and short time delay and instantaneous pickup
    b. Trip Rating: As indicated on drawings.
    c. Features:
        1) Shunt trip.
        2) Auxiliary contacts.
        3) Zone Selective Interlocking, Tied to Downstream Distribution Breakers. .

E. Generator Set General Requirements:

1. Prototype tested in accordance with NFPA 110 for Level 1 systems.
2. Factory-assembled, with components mounted on suitable base.
3. List and label engine generator assembly as complying with UL 2200.
4. Power Factor: Unless otherwise indicated, specified power ratings are at 0.8 power factor for three phase voltages and 1.0 power factor for single phase voltages.
5. Provide suitable guards to protect personnel from accidental contact with rotating parts, hot piping, and other potential sources of injury.
6. Main Line Circuit Breakers: Provide factory-installed line side connections with suitable lugs for load side connections.

F. Service Conditions: Provide engine generator system and associated components suitable for operation under the service conditions at the installed location.

G. Starting and Load Acceptance Requirements:

1. Cranking Method: Cycle cranking complying with NFPA 110 (15 second crank period, followed by 15 second rest period, with cranking limiter time-out after 3 cycles), unless otherwise required.
2. Cranking Limiter Time-Out: If generator set fails to start after specified cranking period, indicate overcrank alarm condition and lock-out generator set from further cranking until manually reset.
3. Start Time: Capable of starting and achieving conditions necessary for load acceptance within 10 seconds (NFPA 110, Type 10).
4. Maximum Load Step: Supports 100 percent of rated load in one step.

H. Exhaust Emissions Requirements:

1. Comply with federal (EPA), state, and local regulations applicable at the time of commissioning; include factory emissions certification with submittals.

2. Do not make modifications affecting generator set factory emissions certification without approval of manufacturer and Engineer. Where such modifications are made, provide field emissions testing as necessary for certification.

I. Sound Level Requirements:

1. Do not exceed 78 dBA when measured at 23 feet from generator set in free field (no sound barriers) while operating at full load; include manufacturer's sound data with submittals.
2. Comply with applicable noise level regulations.

J. Interface with building automation system as specified in Section 230993.

2.3 ENGINE AND ENGINE ACCESSORY EQUIPMENT

A. Provide engine with adequate horsepower to achieve specified power output at rated speed, accounting for alternator efficiency and parasitic loads.

B. Engine Fuel System - Gaseous (Spark Ignition):

1. Fuel Source: Natural gas.
2. Engine Fuel Connections: Provide suitable, approved flexible fuel lines for coupling engine to fuel source.
3. Provide components/features indicated and as necessary for operation and/or required by applicable codes, including but not limited to:
   a. Carburetor.
   b. Gas pressure regulators.
   c. Fuel shutoff control valves.
   d. Low gas pressure switches.

C. Engine Starting System:

1. System Type: Electric, with DC solenoid-activated starting motor(s).
2. Battery(s):
   a. Battery Type: Lead-acid.
   b. Battery Capacity: Size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature; capable of providing cranking through two complete periods of cranking limiter time-outs without recharging.
   c. Provide battery rack, cables, and connectors suitable for the supplied battery(s); size battery cables according to manufacturer's recommendations for cable length to be installed.
3. Battery-Charging Alternator: Engine-driven, with integral solid-state voltage regulation.
4. Battery Charger:
   a. Provide dual rate battery charger with automatic float and equalize charging modes and minimum rating of 10 amps; suitable for maintaining the supplied battery(s) at full charge without manual intervention.
   b. Capable of returning supplied battery(s) from fully discharged to fully charged condition within 24 hours, as required by NFPA 110 for Level 1 applications while carrying normal loads.
   c. Listed as complying with UL 1236.

d. Furnished with integral overcurrent protection; current limited to protect charger during engine cranking; reverse polarity protection.
e. Provide integral DC output ammeter and voltmeter with five percent accuracy.
f. Provide alarm output contacts as necessary for alarm indications.

5. Battery Heater: Provide thermostatically controlled battery heater to improve starting under cold ambient conditions.

D. Engine Speed Control System (Governor):

1. Multiple Engine Generator Sets Operated in Parallel: Provide electronic isochronous governors with automatic load sharing controls.
2. Frequency Regulation, Electronic Isochronous Governors: No change in frequency from no load to full load; plus/minus 0.25 percent at steady state.

E. Engine Lubrication System:

1. System Type: Full pressure, with engine-driven, positive displacement lubrication oil pump, replaceable full-flow oil filter(s), and dip-stick for oil level indication. Provide oil cooler where recommended by manufacturer.
2. Oil Heater: Provide thermostatically controlled oil heater to improve starting under cold ambient conditions.

F. Engine Cooling System:

1. System Type: Closed-loop, liquid-cooled, with unit-mounted radiator/fan and engine-driven coolant pump; suitable for providing adequate cooling while operating at full load under worst case ambient temperature.
2. Fan Guard: Provide suitable guard to protect personnel from accidental contact with fan.
3. Coolant Heater: Provide thermostatically controlled coolant heater to improve starting under cold ambient conditions; size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature.

G. Engine Air Intake and Exhaust System:

1. Air Intake Filtration: Provide engine-mounted, replaceable, dry element filter.
2. Engine Exhaust Connection: Provide suitable, approved flexible connector for coupling engine to exhaust system.
3. Exhaust Silencer: Provide critical grade or better exhaust silencer with sound attenuation not less than basis of design; select according to manufacturer's recommendations to meet sound performance requirements, where specified.

2.4 ALTERNATOR (GENERATOR)

A. Alternator: 4-pole, 1800 rpm (60 Hz output) revolving field, synchronous generator complying with NEMA MG 00001; connected to engine with flexible coupling; voltage output configuration as indicated, with reconnectable leads for 3 phase alternators.

B. Exciter:

1. Exciter Type: Brushless; provide permanent magnet generator (PMG) excitation system; self-excited (shunt) systems are not permitted.
2. PMG Excitation Short-Circuit Current Support: Capable of sustaining 300 percent of rated output current for 10 seconds.

3. Voltage Regulation (with PMG excitation): Plus/minus 0.5 percent for any constant load from no load to full load.

C. Temperature Rise: Comply with UL 2200.

D. Insulation System: NEMA MG 00001, Class H; suitable for alternator temperature rise.

E. Enclosure: NEMA MG 00001, drip-proof.

F. Total Harmonic Distortion: Not greater than five percent.

2.5 GENERATOR SET CONTROL SYSTEM

A. Provide microprocessor-based control system for automatic control, monitoring, and protection of generator set. Include sensors, wiring, and connections necessary for functions/indications specified.

B. Control Panel:

1. Control Panel Mounting: Unit-mounted unless otherwise indicated; vibration isolated.
2. Generator Set Control Functions:
   a. Automatic Mode: Initiates generator set start/shutdown upon receiving corresponding signal from remote device (e.g. automatic transfer switch).
   b. Manual Mode: Initiates generator set start/shutdown upon direction from operator.
   c. Reset Mode: Clears all faults, allowing generator set restart after a shutdown.
   d. Emergency Stop: Immediately shuts down generator set (without time delay) and prevents automatic restarting until manually reset.
   e. Cycle Cranking: Programmable crank time, rest time, and number of cycles.
   f. Time Delay: Programmable for shutdown (engine cooldown) and start (engine warmup).
   g. Voltage Adjustment: Adjustable through range of plus/minus 5 percent.
3. Generator Set Status Indications:
   a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
   b. Current (Amps): For each phase.
   c. Frequency (Hz).
   d. Real power (W/kW).
   e. Reactive power (VAR/kVAR).
   f. Apparent power (VA/kVA).
   g. Power factor.
   h. Duty Level: Actual load as percentage of rated power.
   i. Engine speed (RPM).
   j. Battery voltage (Volts DC).
   k. Engine oil pressure.
   l. Engine coolant temperature.
   m. Engine run time.
   n. Generator powering load (position signal from transfer switch).
4. Generator Set Protection and Warning/Shutdown Indications:
   a. Comply with NFPA 110; configurable for NFPA 110 Level 1 or Level 2, or NFPA 99 systems including but not limited to the following protections/indications:
      1) Overcrank (shutdown).

2) Low coolant temperature (warning).
3) High coolant temperature (warning).
4) High coolant temperature (shutdown).
5) Low oil pressure (shutdown).
6) Overspeed (shutdown).
7) Low fuel level (warning).
8) Low coolant level (warning/shutdown).
9) Generator control not in automatic mode (warning).
10) High battery voltage (warning).
11) Low cranking voltage (warning).
12) Low battery voltage (warning).
13) Battery charger failure (warning).

b. In addition to NFPA 110 requirements, provide the following protections/indications:
1) High AC voltage (shutdown).
2) Low AC voltage (shutdown).
3) High frequency (shutdown).
4) Low frequency (shutdown).
5) Overcurrent (shutdown).

c. Provide contacts for local and remote common alarm.

d. Provide lamp test function that illuminates all indicator lamps.

5. Other Control Panel Features:
a. Event log.
b. Communications Capability: Utilize Modbus communications protocol. Provide all accessories necessary for proper interface.
c. Remote monitoring capability via PC.

C. Remote Annunciator:

1. Remote Annunciator Mounting: Wall-mounted; Provide flush-mounted annunciator for finished areas and surface-mounted annunciator for non-finished areas unless otherwise indicated.
2. Generator Set Status Indications:
a. Generator powering load (via position signal from transfer switch).
b. Communication functional.
3. Generator Set Warning/Shutdown Indications:
a. Comply with NFPA 110; configurable for NFPA 110 Level 1 or Level 2, or NFPA 99 systems including but not limited to the following indications:
1) Overcrank (shutdown).
2) Low coolant temperature (warning).
3) High coolant temperature (warning).
4) High coolant temperature (shutdown).
5) Low oil pressure (shutdown).
6) Overspeed (shutdown).
7) Low fuel level (warning).
8) Low coolant level (warning/shutdown).

9) Generator control not in automatic mode (warning).
10) High battery voltage (warning).
11) Low cranking voltage (warning).
12) Low battery voltage (warning).
13) Battery charger failure (warning).

b. Provide audible alarm with silence function.
c. Provide lamp test function that illuminates all indicator lamps.

D. Remote Emergency Stop: Provide approved red, mushroom style remote emergency stop button where indicated or required by authorities having jurisdiction.

2.6 GENERATOR SET ENCLOSURE

A. Enclosure Type: Sound attenuating, weather protective.

B. Enclosure Material: Aluminum.

C. Hardware Material: Stainless steel.

D. Color: Manufacturer's standard.

E. Access Doors: Lockable, with all locks keyed alike.

F. Openings: Designed to prevent bird/rodent entry.

G. External Drains: Extend oil and coolant drain lines to exterior of enclosure for maintenance service.

H. Sound Attenuating Enclosures: Line enclosure with non-hydroscopic, self-extinguishing sound-attenuating material.

I. Utilize an upward discharging radiator hood.

J. Exhaust Silencers: Where exhaust silencers are mounted within enclosure in main engine compartment, insulate silencer to minimize heat dissipation as necessary for operation at rated load under worst case ambient temperature.

K. Enclosure Space Heater: Provide thermostatically controlled enclosure space heater to prevent condensation and improve starting under cold ambient conditions; size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature.

2.7 SOURCE QUALITY CONTROL

A. See Section 01.4000 - Quality Requirements, for additional requirements.

B. Perform production tests on generator sets at factory to verify operation and performance characteristics prior to shipment. Include certified test report with submittals.

C. Generator Set production testing to include, at a minimum:

1. Operation at rated load and rated power factor.
2. Single step load pick-up.
3. Transient and steady state voltage and frequency performance.
4. Operation of safety shutdowns.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of generator sets and auxiliary equipment are consistent with the indicated requirements.

C. Verify that rough-ins for field connections are in the proper locations.

D. Verify that mounting surfaces are ready to receive equipment.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install generator sets and associated accessories in accordance with NECA/EGSA 404.

D. Arrange equipment to provide minimum clearances and required maintenance access.

E. Unless otherwise indicated, mount generator set on properly sized, minimum 6 inch high concrete pad constructed in accordance with Section 03.3000.

F. Provide required support and attachment in accordance with Section 26.0529.

G. Provide required vibration isolation and/or seismic controls in accordance with Section 26.0548.

H. Use manufacturer's recommended oil and coolant, suitable for the worst case ambient temperatures.

I. Provide natural gas piping in accordance with Section 23.1123.

J. Provide engine exhaust piping in accordance with Section 23.5100, where not factory installed.

1. Include piping expansion joints, piping insulation, thimble, condensation trap/drain, rain cap, hangers/supports, etc. as indicated or as required.
2. Do not exceed manufacturer's maximum back pressure requirements.

K. Do not insulate piping for engine components restricted by manufacturer.

L. Install exhaust silencer in accordance with Section 23.5100, where not factory installed.

M. Provide grounding and bonding in accordance with Section 26.0526.

N. Identify system wiring and components in accordance with Section 26.0553.

3.3 FIELD QUALITY CONTROL

A. See Section 01.4000 - Quality Requirements, for additional requirements.

B. Provide services of a manufacturer's authorized representative to prepare and start systems and perform inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.

C. Notify Owner and Architect at least two weeks prior to scheduled inspections and tests.

D. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

E. Provide all equipment, tools, and supplies required to accomplish inspection and testing, including load bank and fuel.

F. Preliminary inspection and testing to include, at a minimum:

1. Inspect each system component for damage and defects.
2. Verify tightness of mechanical and electrical connections are according to manufacturer's recommended torque settings.
3. Check for proper oil and coolant levels.

G. Prepare and start system in accordance with manufacturer's instructions.

H. Perform acceptance test in accordance with NFPA 110.

I. Inspection and testing to include, at a minimum:

1. Verify compliance with starting and load acceptance requirements.
2. Verify voltage and frequency; make required adjustments as necessary.
3. Verify phase sequence.
4. Verify control system operation, including safety shutdowns.
5. Verify operation of auxiliary equipment and accessories (e.g. battery charger, heaters, etc.).
6. Perform load tests in accordance with NFPA 110 (1.5 hour building load test followed by 2 hour full load test).

J. Provide field emissions testing where necessary for certification.

K. Sound Level Tests: Measure sound levels for compliance with specified requirements. Identify and report ambient noise conditions.

L. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

M. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.4 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.5 CLOSEOUT ACTIVITIES

A. See Section 01.7800 - Closeout Submittals, for closeout submittals.

B. See Section 01.7900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.

D. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of four hours of training.
3. Instructor: Manufacturer's authorized representative.
4. Location: At project site.

E. After successful acceptance test and just prior to Substantial Completion, replace air, oil, and fuel filters .

3.6 PROTECTION

A. Protect installed engine generator system from subsequent construction operations.

3.7 MAINTENANCE

A. See Section 01.7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide to Owner a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of engine generator system for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, inspection, and testing, with a detailed schedule.

C. Conduct site visit at least once every three months to perform inspection, testing, and preventive maintenance. Submit report to Owner indicating maintenance performed along with evaluations and recommendations.

D. Provide trouble call-back service upon notification by Owner:

1. Provide on-site response within 4 hours of notification.
2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

E. Maintain an on-site log listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced.

END OF SECTION 26.3213

SECTION 26.3600 - TRANSFER SWITCHES

PART 1 GENERAL

1.1 SCOPE

A. Furnish and install automatic transfer switches (ATS) with number of poles, amperage, voltage, and withstand current ratings as shown on the plans. Each automatic transfer shall consist of an inherently double throw power transfer switch unit and a microprocessor controller, interconnected to provide complete automatic operation. All transfer switches and control panels shall be the product of the same manufacturer.

B. Furnish an enclosure for the (3AUS) that is for service entrance. It shall provide all of the proper disconnecting, protection, grounding and bonding required for service entrance equipment.

1.2 ACCEPTABLE MANUFACTURERS

A. Service entrance automatic transfer switches shall be ASCO Series 3AUS. Any alternate shall be submitted to the consulting engineer in writing at least 10 days prior to bid. Each alternate bid must list any deviations from this specification.

1.3 CODES AND STANDARDS

A. The service entrance automatic transfer switch and accessories shall conform to the requirements of:

1. UL 1008 Listed for Optional Standby Transfer Switches (Manual Transfer Switches)
2. CSA C22.2 No.178 1978
3. IEC 60947-6-1 Low – Voltage Switchgear and Controller
4. NFPA 70 - National Electrical Code
5. NFPA 99 – Essential Electrical Systems for Health Care Facilities
6. IEEE Standard 446 - IEEE Recommended Practice for Emergency and StandbyPower Systems for Commercial and Industrial Applications
7. UL 508 Industrial Control Equipment
8. UL 891 Switchboards
9. NEC Articles 700, 701, 702
10. International Standards Organization ISO 90estrication 01: 2008
11. RoHs compliant (Restriction of Hazardous Substances)
    a. Seismic qualification – International Building Code & OSHPD to SDS level of 2.5

PART 2 PRODUCTS

2.1 ATS INFO

A. (ATS#2) Service Entrance Automatic transfer switch – Delayed Transition – 2500A – 208V – Switched Neutral – NEMA 3R Enclosure – Load Shed

B. (ATS#1) Automatic transfer switch – Open Transition – 260A – 208V – Switched Neutral – NEMA 1 Enclosure

C. Non-automatic transfer switch – Open Transition – 260A – 208V – Switched Neutral – NEMA 3R Enclosure

D. 5350 annunciator

E. 5101-Gen Kit – Start signal monitoring

2.2 ATS ACCESSORIES

A. 6DL Description (NTS only): Retransfer to normal mode. While in manual retransfer mode if an emergency source failure should occur and the normal source is still available manual retransfer will be automatically bypassed. A pilot light indicates manual retransfer mode.

B. 7ES Description : 5101 Engine Start Circuit Monitor. 5101-ATS module pre-wired to the Feature 7 NC Start Signal ready for integration into a engine start monitoring system. (Must be wired to 5101-GEN module at generator)

C. 11BE Description : Adds the following features to the Group G controller: (1) Serial RS-485 Modbus Communications (2) Multi-Schedule Engine Exerciser (3) a 300 Entry Event Log and (4) a common alarm output function. When applied on 3-phase systems it also enables: (1) 3-Phase Emergency Source VLL sensing (2) Phase Rotation Monitoring (3) Emergency Source VLL Unbalance Monitoring.

D. 18RX Description : REX (Relay Expansion Module) with Normal and Emergency available output contacts (18B & 18G)

E. 44G Description: (NEMA 3R ONLY) Enclosure Heater - A 125 watt enclosure heater with transformer and thermostat (adjustable from 30□ to 140 □ F) shall be provided for outdoor installations where type 3R accessory 44G, and shall be capable of being added to existing switches).

F. 72EE Description : Quad - Ethernet Module with AES - 128 bit with encryption and (4) RJ - 45s, includes 11BE feature bundle

G. 135L Description : Power Meter on Load Side with CT

H. 30AA: Load shed by auxiliary contact

2.3 MECHANICALLY HELD TRANSFER SWITCH

A. The transfer switch unit shall be electrically operated and mechanically held. The electrical operator shall be a single-solenoid mechanism, momentarily energized. Main operators which include overcurrent disconnect devices will not be accepted. The switch shall be mechanically interlocked to ensure only one of two possible positions, normal or emergency.

B. The switch shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and operating life.

C. All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented, blow-on construction for high withstand current capability and be protected by separate arcing contacts.

D. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes. The handle shall permit the operator to manually stop the contacts at any point throughout their entire travel to inspect and service the contacts when required.

E. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.

F. Where neutral conductors must be switched, the ATS shall be provided with fully-rated neutral transfer contacts.

G. Where neutral conductors are to be solidly connected, a neutral terminal plate with fully-rated AL-CU pressure connectors shall be provided.

2.4 GROUP G CONTROLLER WITH INTEGRATED USER INTERFACE PANEL

A. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance.

B. The controller shall direct the operation of the transfer switch. The controller's sensing and logic shall be controlled by a built – in microprocessor for maximum reliability, minimum maintenance, inherent serial communications capability, and the ability to communicate via Ethernet through optional communications module.

C. A single controller shall provide single and three phase capability for maximum application flexibility and mimimal spare part requirements. Voltage sensing shall be true RMS type and shall be accurate to ± 1% of nominal voltage. Frequency sensing shall be accurate to ± 0.1 Hz. Time delay settings shall be accurate to ± 0.5% of the full scale value of the time delay. The panel shall be capable of operating over a temperature range of -20 to + 70 degrees C, and storage from -55 to + 85 degrees C.

D. The controller shall be enclosed with a protective cover and be mounted separate from the transfer switch unit for safety and ease of maintenance. Sensing and control logic shall be provided on printed circuit boards.

E. The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:

1. IEC 60947-6-1 Multiple Function Equipment Transfer Switching Equipment.
   61000-4 Testing And Measurement Techniques – Overview
   a. IEC 61000 – 4 – 2 Electrostatic Discharge Immunity
   b. IEC 61000 - 4 – 3 Radiated RF Field Immunity
   c. IEC 61000 – 4 – 4 Electrical Fast Transient/Burst Immunity
   d. IEC 61000 – 4 – 5 Surge Immunity
   e. IEC 61000 – 4 – 6 Conducted RF Immunity
2. CISPR 11 – Conducted RF Emissions and Radiated RF Emissions

2.5 ENCLOSURE

A. The service entrance 3AUS shall be furnished in a NEMA type 1 enclosure unless otherwise shown on the plans.

B. Provide strip heater with thermostat for Type 3R enclosure requirements.

C. Controller shall be mounted on, visable, and operational through enclosure door..

D. The complete assembly shall be degreased, and thoroughly cleaned through a five-stage aqueous process. The finish shall be ANSI-61, light gray, electrostatically-charged polyester powder paint over a phosphate coating, at a minimum of 2.0 mils in density. Finish shall be suitable for indoor and outdoor environments.

E. For those automatic transfer switches that are less than 1000 amperes, the connection between the normal disconnecting device and the ATS shall be made with the appropriate size cable. For those automatic transfer switches that are greater than 1000 amperes, the connection between the normal disconnecting device and the ATS shall be made with the appropriate size bus. Bus shall be silver plated copper rated no less than 1000 amps per square inch.

F. A pressure disconnect link shall be provided to disconnect the normal source neutral connection from the emergency and load neutral connections for 4-wire applications. A ground bus shall be provided for connection of the grounding conductor to the grounding electrode. A pressure disconnect link for the neutral to ground bonding jumper shall be provided to connect the normal neutral connection to the ground bus.

G. Control wiring shall be rated for 600 volt, UL 1015. Wires shall be placed in wire duct or harnessed, and shall be supported to prevent sagging or breakage from weight or vibration. All wiring to hinged doors shall be run through door terminal blocks or connection plugs.

PART 3 OPERATIONS

3.1 CONTROLLER DISPLAY AND KEYPAD

A. A 128*64 graphical LCD display and keypad shall be an integral part of the controller for viewing all available data and setting desired operational parameters.
Operational parameters shall also be available for viewing and limited control through communications port. The following parameters shall only be adjustable via DIP switches on the controller.

1. Nominal line voltage and frequency
2. Single or three phase sensing on normal
3. Transfer operating mode configuration, (open transition, or delayed transition)
All instructions and controller settings shall be easily accessible, readable and accomplished without the use of codes, calculations, or instruction manuals.

3.2 VOLTAGE AND FREQUENCY SENSING

A. Voltage and frequency on both the normal and emergency sources (as noted below) shall be continuously monitored, with the following pickup, dropout, and trip settings capabilities (values shown as % of nominal unless otherwise specified.

1.	Parameter	Sources	Dropout/Trip	Pickup/Reset
a.	Undervoltage	N & E	70 to 98%	85 to 100%
b.	Overvoltage	N & E	102 to116%	2% below trip
c.	Underfrequency	N & E	85 to 98%	86 to 100%
d.	Overfrequency	N & E	101 to 111%	2% bellow trip

B. Repetitive accuracy of all settings shall be within 1% at +25C

C. Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad or remotely via serial communications port access.

D. Source status screens shall be provided for both normal & emergency to provide digital readout of voltage and frequency. *Note: Single phase sensing on emergency*

E. The backlit 128*64 graphical display shall have multiple language capability.
Languages can be selected from the user interface.

3.3 TIME DELAYS

A. A time delay shall be provided to override momentary normal source outages and delay all transfer and engine starting signals, adjustable 0 to 6 seconds. It shall be possible to bypass the time delay from the controller user interface.

B. A time delay shall be provided on transfer to emergency, adjustable from 0 to 60 minutes 59 seconds for controlled timing of transfer of loads to emergency. It shall be possible to bypass the time delay from the controller user interface.

C. A generator stabilization time delay shall be provided after transfer to emergency adjustable 0 or 4 seconds.

D. A time delay shall be provided on retransfer to normal, adjustable 0 to 9 hours 59 minutes 59 seconds. Time delay shall be automatically bypassed if emergency source fails and normal source is acceptable.

E. A cooldown time delay shall be provided on shutdown of engine generator, Adjustable 0 to 60 minutes 59 seconds.

F. All adjustable time delays shall be field adjustable without the use of special tools.

G. A time delay activated output signal shall also be provided to drive an external relay(s) for selective load disconnect control. The controller shall have the ability to activate an adjustable 0 to 5 minutes 59 seconds time delay in any of the following modes:

1. Prior to transfer only.
2. Prior to and after transfer.
3. Normal to emergency only.
4. Emergency to normal only.
5. Normal to emergency and emergency to normal.
6. All transfer conditions or only when both sources are available.

H. In the event that the alternate source is not accepted within the configured Failure to Accept time delay, the common alert indication shall become active.

I. The controller shall also include the following built-in time delay for delayed transition operation.

1. A time delay for the load disconnect position for delayed transition operation adjustable 0 to 5 minutes 59 seconds.

3.4 ADDITIONAL FEATURES

A. The user interface shall be provided with test/reset modes. The test mode will simulate a normal source failure. The reset mode shall bypass the time delays on either transfer to emergency or retransfer to normal.

B. A set of contacts rated 5 amps, 30 VDC shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down. setting, regardless of whether the normal source restores before the load is transferred.

C. Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting of one contact, closed when the ATS is connected to the normal source and one contact closed when the ATS is connected to the emergency source.

D. A single alarm indication shall light up the alert indicator and de – energize the configured common alarm output relay for external monitoring.

E. LED indicating lights shall be provided; one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red).

F. LED indicating lights shall be provided and energized by controller outputs. The lights shall provide true source availability of the normal (green) and emergency (red) source, as determined by the voltage sensing trip and reset settings for each source.

G. LED indicating light shall be provided to indicate switch not in automatic mode (manual); and blinking (amber) to indicate transfer inhibit.

H. LED indicating light shall be provided to indicate any alarm condition or active time delay (red).

The following features shall be built – in to the controller, but capable of being activated through keypad programming or the serial port only when required by the user:

I. Provide the ability to select "commit/no commit to transfer" to determine whether the load should be transferred to the emergency generator if the normal source restores before the generator is ready to accept the load.

J. A variable window inphase monitor shall be provided in the controller. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The inphase monitor shall be specifically designed for and be the product of the ATS manufacturer. The inphase monitor shall be equal to ASCO feature 27.

K. An engine generator exercising timer shall be provided to configure weekly and bi-weekly automatic testing of an engine generator set with or without load for 20 minutes fixed. It shall be capable of being configured to indicate a day of the week, and time weekly testing should occur.

The following feature shall be built – into the controller, but capable of being activated through keypad programming, communications interface port, or additional hardware.

L. Terminals shall be provided for a remote contact to signal the ATS to transfer to emergency. This inhibit signal can be enabled through the keypad or serial port.

M. System Status –

1. The controller LCD display shall include a "System Status" screen which shall be readily accessible from any point in the menu by depressing the "ESC" key. This screen shall display a clear description of the active operating sequences and switch position. For example,

a Normal Failed
b. Load on Normal
c. TD Normal to Emerg
d. 2min15s

2. Controllers that require multiple screens to determine system status or display "coded" system status messages, which must be explained by references in the operator's manual are not permissible.

N. Self Diagnostics – The controller shall contain a diagnostic screen for the purpose of detecting system errors. This screen shall provide information on the status input signals to the controller which may be preventing load transfer commands from being completed.

O. Communications Interface – The controller shall be capable of interfacing, through an optional serial communication port with a network of transfer switches, locally (up to 4000 ft.). Standard software specific for transfer switch applications shall be available by the transfer switch manufacturer. This software shall allow for the monitoring, control, and setup of parameters.

P. Data Logging – The controller shall have the ability to log data and to maintain the last 300 events, even in the event of total power loss. The following events shall be time and date stamped and maintained in a non – volatile memory.

1. Event Logging
   a. Data and time and reason for transfer normal to emergency
   b. Data and time and reason for transfer emergency to normal
   c. Data and time and reason for engine start
   d. Data and time engine stopped
   e. Data and time emergency source available
   f. Data and time emergency source not available
2. Statistical Data
   a. Total number of transfers
   b. Total number of transfers due to source failure
   c. Total number of day's controller is energized
   d. Total number of hours both normal and emergency sources are Available
   e. Total time load is connected to normal
   f. Total time load is connected to emergency
   g. Last engine start
   h. Last engine start up time
   i. Input and output status

3.5 OPTIONAL FEATURES

A. Accessory Package - An accessory bundle shall be provided that includes:

1. A fully programmable engine exerciser with seven independent routines to exercise the engine generator, with or without load on a daily weekly, bi – weekly, or monthly basis.
2. Event log display that shows event number, time and date of events, event type, and reason (if applicable). A minimum of 300 events shall be stored.
3. RS – 485 communications port enabled.
4. Common alarm output contact.
   (This feature shall be equal to ASCO accessory 11BE, and shall be capable of being activated for existing switches through optional accessory dongle).

B. Expansion Module - A relay expansion module (REX) is a standard feature when delayed transition transfer is specified. A REX module shall also be provided for open transition transfer that includes one form C contact for source availability of the normal (18G) and emergency (18B) sources. Additional output relay shall be provided to indicate a common alarm. The REX module shall have the capability of being daisy chained for multiple sets of contacts. (This feature shall be equal to ASCO accessory 18RX, and shall be capable of being added to existing switches without modification).

C. Communications Module – Shall provide remote interface module to support monitoring of vendor's transfer switch, controller and optional power meter. Module shall provide status, analog parameters, event logs, equipment settings & configurations over embedded webpage and open protocol. Features shall include:

1. Email notifications and SNMP traps of selectable events and alarms may be sent to a mobile device or PC.
2. Modbus TCP/IP, SNMP, HTTP, SMTP open protocols shall be simultaneously supported.
3. Web app interface requiring user credentials to monitor and control the transfer switch supporting modern smart phones, tablets and PC browsers. User will be able to view the dynamic one-line, ATS controls status, alarms, metering, event logging as well as settings.
4. Secure access shall be provided by requiring credentials for a minimum of 3 user privilege levels to the web app, monitor (view only), control (view and control) and administrator (view, control and change settings). 128-Bit AES encryption standard shall be supported for all means of connectivity.
5. Shall allow for the initiating of transfers, retransfers, bypassing of active timers and the activating/deactiviting of engine start signal shall be available over the embedded webpage and to the transfer switch vendor's monitoring equipment.
6. An event log displaying a minimum of three-hundred (300) events shall be viewable and printable from the embedded webpages and accessible from supported open protocols.
7. Four (4) 100 Mbps Ethernet copper RJ-45 ports, two (2) serial ports, and LEDs for diagnostics.
8. DIN rail mountable.

This option shall be equivalent to ASCO accessory 72EE

D. Enclosure Heater - A 125 watt enclosure heater with transformer and thermostat (adjustable from 30° to 140 ° F) shall be provided for outdoor installations where type 3R, 4, are specified. (This feature shall be equal to ASCO accessory 44G, and shall be capable of being added to existing switches).

I . Power Meter – (This feature shall be equal to ASCO accessory 135L, or feature bundle accessory 150*).

2. The Power Meter shall conform to the requirements of:
   a. UL 3111-1-Electrical Measuring and Testing Equipment
   b. CAN/CSA-C22.2 No. 23-M89-CSA Safety Requirements for Electrical and Electronic Measuring and Test Equipment

c. The Power Meter shall be capable of operating without modification at a nominal frequency of 45 to 66Hz.
d. The Power Meter shall be rated for an operating temperature of -4°F to 158°F and a storage temperature of -22°F to 176°F. and shall be rated for an 85% non-condensing, relative humidity.
e. The Power Meter shall accept inputs from industry standard instrument transformers (120 VAC secondary PT's and 5A secondary CT's). Direct phase voltage connections, 0 to 600VAC nominal, shall be possible without the use of PT's.
f. The Power Meter shall accept single, 3 phase, or three & four wire circuits. A fourth CT input shall be available to measure neutral or ground current.
g. The Power Meter shall contain a built-in discrete contact to wire an ATS 14A auxiliary contact to indicate switch position.
h. The Power Meter shall accept AC voltage from the sensing lines for operation. Additional provisions shall be provided for external DC voltage input range 9-36 VDC with a nominal of 24 VDC.
i. The Power Meter shall be equipped with a continuous duty, long –life, 4 line x 20 character green backlit LCD.
j. All setup parameters required by the Power Meter shall be stored in non-volatile memory and retained in the event of a control power interruption.
k. The Power Meter shall be flush mountable on a surface.
l. The Power Meter enclosure shall be sealed to IP-51 (NEMA 1) and the faceplate shall be sealed to IP-65 (NEMA 4). All push buttons shall be sealed tact switches.
m. The Power Meter shall send, when prompted, information to a central location equipped with a manufacturer supplied critical power management system or 3rd party monitor through manufacturer supplied communication modules. All 3rd party monitor must utilize industry standard open protocols Modbus/RTU.Modbus/TCP or SNMP.
n. An embedded RS-485 port will be provided which will enable communication at 9600, 19.2K, 38.4K, or 57.6K baud. DIP switches will be provided on the RS-485 port allowing a user to select 2-wire or 4-wire communication as well as the option to activate a terminating resistor on the port.
o. The Power Meter shall help facilities comply with NEC 220. It shall provide Maximum Demand calculations for the past 24 months, as per standards with 15 minute averages.
p. The following data will be available on the display and Modbus registers of the Power Meter:
    1) Line-to-neutral voltages (V_{AN}, V_{BN}, and V_{CN})
    2) Line-to-neutral voltage average (V_{AVE})
    3) Line-to-line voltages (V_{AB}, V_{BC}, and V_{CA})
    4) Line-Line voltage average (V_{LAVE})
    5) Current on each phase (I_A,I_B,and I_C)
    6) Current on the neutral conductor (I_N)
    7) Average current (I_{AVE})
    8) Active power, KW per phase and total (W_A,W_B,W_C, and WT)
    9) *Apparent power, KVA per phase and total (V_{AA}, V_{AB}, V_{AC}, and V_{AT})*

10) *KWHours importing, exporting and net (KWH_{IMP}, KWH_{EXP}, and KWH_{NET})*
11) *KVARHours leading, lagging and net ($KVARH_{LEAD}$, KVARLAG, and KVARHNET)*
12) *Power factor (PF)*
13) *Signal Frequency (Hz)*
14) *Digital Input*

q. The Power Meter shall offer an LCD which can display no less then nine different languages.

r. Displaying each of the metered values shall be done through the use of menu scroll buttons. There will be an escape button which will be used to take the user back to the previous page or to cancel a setting change. Pressing escape no more than three times will return the user to the home screen.

s. For ease of operator viewing, the display can be configured to remain on continuously, with no detrimental effect on the life of the Power Meter.

t. The display's contrast shall be configurable in intervals of 10% (ranging 0%-100%).

u. Setup of a system requirements shall be allowed from the front of the Power Meter.

3.6 ATS REMOTE ANNUNCIATOR

A. General

1. Provide and install ATS Remote Annunciators for monitoring and control of automatic transfer switches remotely over Ethernet.

B. Hardware Specifications

1. The ATS Remote Annunciator shall be listed to cUL-60950-1 and UL 1008 and include the following features and ratings*:*
   a. User-configured labels with ATS names and power sources
   b. Dual 10/100 Base-T auto sensing and auto crossover Ethernet ports
   c. LED indication of source acceptability, switch position, common alarm, time delay and Ethernet link activity
   d. Push button for transfer/retransfer control operations and time delay bypass
   e. Push buttons for Alarm Silence and Lamp Test
   f. Key lock to enable and disable the transfer push button
   g. Audible and visual alarm to indicate Communication Error ATS Locked Out Failure to Synchronize Extended Parallel and any of the 8 user-configured discrete inputs
   h. Programmable watchdog timer that can generate a system reset upon timeout (minimum 1 sec)
   i. Factory reset capability
   j. 100 ms power ride-through

C. Software Specification

1. The ATS Remote Annunciator shall contain embedded web pages accessible via various web browsers with the following capabilities:
   a. Configuration for protocol and communications management with the ability of auto discovering transfer switches on network
   b. Ability to create and print customized labels for ATS names and power sources
   c. The ability to choose a continuous or periodic audible alarm with customizable interval time
   d. View detailed packet status counters i.e. transmitted received and dropped packets with the ability to reset counters
   e. ATS source name configuration page which allows users to configure power source names and print labels
   f. Upgrade firmware from Ethernet network without interrupting equipment operation

D. Communications

1. Dual 10/100 Base-T (RJ-45) Ethernet ports are provided to support TCP/IP communications for up to eight automatic transfer switches via individual remote connectivity modules or daisy-chained serial modules into a single Connectivity Module. Additional features include:
   a. Supports Full Duplex Flow Control (IEEE 802.3x)
   b. 3.3V power supply with 5V I/O tolerance
   c. Supports 3 LEDs to indicate traffic link speed and collision

E. Mounting

1. The ATS Remote Annunciator is suitable for:
   a. Surface mounting using mounting screws studs
   b. Flush Mount from behind a cutout section (Enclosure Door Mounting)
   c. Flush Mount from the front of a cutout section (Enclosure Door Mounting)

F. Power Supply

1. The ATS Remote Annunciator shall be capable of accepting 24VDC, 120 VAC or 240 VAC power source.

G. Environmental

1. The ATS Remote Annunciator shall have an Ambient Operating Temperature range of -4 º to 158 º F (-20 º to +70 º C) @ 5~85% humidity and Ambient Storage Temperature of -40 º to 185 º F (-40 º to 85 º C).

3.7 DISCONNECTING AND OVERCURRENT PROTECTION DEVICE

A. For those automatic transfer switches less than 1000 amperes, the normal connection shall be provided with a thermal magnetic rated molded case circuit breaker with current ratings as shown on the plans. It shall have a thermal magnetic trip unit.

B. For those automatic transfer switches rated above 1000 amperes, the normal connection shall be provided with a stationary mount, insulated case circuit breaker with a solid-state trip unit. The trip unit shall have an adjustable long time, short time, instantaneous, and ground fault trip settings. The insulated case circuit breaker shall trip open when the ground fault setting is exceeded.

3.8 ADDITIONAL REQUIREMENTS

A. AMPERE INTERRUPTING CAPACITY (AIC)

1. The maximum short circuit current the breaker shall be required to interrupt is as follows:

a. Switch Rating	AIC Rating	Voltage
1) 70 - 225	25,000A	480V
2) 250, 400	50,000A	480V
600	50,000A	480V
3) 800 – 2000	65,000A	480V
4) 2500, 3000	100,000A	480V

B. TESTS AND CERTIFICATION

1. The complete 3AUS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.
2. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards, and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.
3. The ATS manufacturer shall be certified to ISO 9001 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation and servicing in accordance with ISO 9001:2008.

C. SERVICE REPRESENTATION

1. The ATS manufacturer shall maintain a national service organization of company-employed personnel located throughout the contiguous United States. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.
2. The manufacturer shall maintain records of each switch, by serial number, for a minimum of 20 years.
3. For ease of maintenance and parts replacement, the switch nameplate shall include drawing numbers, part numbers for main coil and control.

END OF SECTION 26.3600

SECTION 26.3633 - CONNECTION CABINETS FOR PORTABLE GENERATORS AND LOAD BANKS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Permanently installed connection cabinets/docking stations with provisions for temporary power connections to portable equipment.

1.2 RELATED REQUIREMENTS

A. Section 03.3000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 26.0526 - Grounding and Bonding for Electrical Systems.

C. Section 26.0529 - Hangers and Supports for Electrical Systems.

D. Section 26.0548 - Vibration and Seismic Controls for Electrical Systems.

E. Section 26.0553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 26.0573 - Power System Studies: Additional criteria for the selection of equipment specified in this section.

G. Section 26.3213 - Engine Generators: Permanently installed generators.

H. Section 26.3600 - Transfer Switches.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 1008 - Transfer Switch Equipment; Current Edition, Including All Revisions.

E. UL 1773 - Termination Boxes; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate compatibility of products and installation with Owner-furnished portable generators/load banks.
2. Coordinate work to avoid placement of ductwork, piping, equipment, and other obstructions within dedicated equipment spaces and working clearances required by NFPA 70.
3. Coordinate arrangement of equipment with dimensions and clearance requirements of actual equipment to be installed.
4. Coordinate work with placement of supports and anchors required for mounting.
5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Preinstallation Meeting: Where applicable, conduct meeting with permanently installed generator manufacturer representative and installer to review proposed system configuration.

C. Where work involves interruption of existing electrical service, arrange service interruption with Owner.

1.5 SUBMITTALS

A. See Section 01.3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features.

C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing factory and field connections.

1. Identify mounting conditions required for equipment seismic qualification.

D. Manufacturer's equipment seismic qualification certification.

E. Manufacturer's qualification statement.

F. Installer's qualification statement.

G. Field quality control test reports.

H. Operation and Maintenance Data: Include detailed information on system operation, replacement parts, and recommended maintenance procedures and intervals.

I. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

1.6 QUALITY ASSURANCE

A. Comply with the following:

1. NFPA 70.
2. Requirements of authorities having jurisdiction.
3. Applicable local codes.
4. _____.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with power transfer systems of similar size, type, and complexity.

D. Product Evaluation and Listing Organization Qualifications: Organization engaged in evaluation of products and services, including those recognized by OSHA as Nationally Recognized Testing Laboratories (NRTL), and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store in clean, dry space. Maintain factory wrapping or provide additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's instructions to avoid damage to components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

A. See Section 01.7800 - Closeout Submittals, for additional warranty requirements.

B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Substitutions: See Section 01.6000 - Product Requirements.

B. Source Limitations: Provide connection cabinets and accessories produced by single manufacturer and obtained from single supplier.

2.2 CONNECTION CABINETS/DOCKING STATIONS

A. Description: Cabinets with provisions for temporary facility connection to portable generators and/or load banks.

B. General Requirements:

1. Listed as complying with UL 1008 or UL 1773.
2. Temporary Connectors:
    a. Camlocks: Single-pole, series 16; 400 A rated.
    b. Lugs: Single-pole, mechanical type.
3. Input Camlock Connections for Generator: For each row, provide five camlock connectors (one for each phase, one for neutral, and one for ground).
4. Output Camlock Connections for Load Bank: For each row, provide four camlock connectors (one for each phase and one for ground).
5. Camlock Connector Color Code:
    a. 240 V and Below:
        1) Phase 1: Black.
        2) Phase 2: Red.
        3) Phase 3, Where Required: Blue.
    b. 277 V to 480 V:
        1) Phase 1: Brown.
        2) Phase 2: Orange.
        3) Phase 3: Yellow.
    c. Neutral: White.
    d. Ground: Green.
6. Equipment Ground: Bonded to enclosure.

7. Bus Bar:
   a. Material: Tin-plated copper, unless otherwise indicated.
   b. Provide permanent connection to facility with mechanical set screw lugs.
8. Neutral Configuration:
   a. Input for Generator: 100 percent rated.
   b. Output for Load Bank: No neutral.
9. Temporary Cable Provisions: Provide access wiring entry/exit for conductors, with no sharp edges that may come in contact with conductor insulation.

C. Enclosure:

1. Material: Aluminum.
2. NEMA EN 10250 Rating: Type 3R.
3. Front Door: Lockable; capable of securing connection cables when locked.
4. Temporary Cable Access Panel: Hinged plate for bottom entry, mechanically interlocked with front door.
5. Finish Color: Manufacturer's standard.

D. Short Circuit Current Rating: Where not specified, provide connection cabinet with listed short circuit current rating not less than available fault current at installed location as indicated on drawings.

E. Connection Cabinet:

1. Input/Output Configurations: Input for generator, male camlocks.
2. Main Disconnect: No disconnect.
3. Ground: Minimum 25 percent rated.
4. Phase Poles: Four.
5. Ampere Rating: 400.
6. Voltage for Color Codes: As indicated on drawings.
7. Mounting Configuration: Wall mounted.
8. Features:
   a. Two-wire auto start.
   b. Drip hood.
   c. Camlock snap covers.
9. Products:
   a. Schneider Electric; ASCO 300 Series; Quick Connect Power Panel: www.ascopower.com/#sle.
   b. Substitutions: See Section 01.6000 - Product Requirements.

F. Accessories:

1. 400 A camlock cable set; length and quantity as required for connection to portable equipment.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify field measurements.

B. Verify ratings and configurations of connection cabinets and associated components.

C. Verify locations of rough-ins for field connections.

D. Verify mounting surfaces are ready to receive connection cabinets.

E. Verify conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Comply with NECA 1 for general workmanship.

B. Install products in accordance with manufacturer's instructions.

C. Arrange equipment to provide minimum clearances and required maintenance access; provide adequate space for temporary cable connections.

D. Provide required support and attachment; see Section 26.0529.

E. Install connection cabinets plumb and level.

F. Unless otherwise indicated, mount floor-mounted connection cabinets on properly sized concrete pad 3 inches in height.

1. See Section 03.3000.

G. Provide grounding and bonding; see Section 26.0526.

H. Provide identification; see Section 26.0553.

1. Identify system wiring and components.
2. Connection Cabinets for Portable Generators:
    a. Use identification nameplate to identify phase rotation.
    b. Use warning label or identification nameplate to identify system bonding requirements in accordance with NFPA 70.

3.3 FIELD QUALITY CONTROL

A. See Section 01.4000 - Quality Requirements for additional requirements.

B. Test system operation.

C. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

D. Provide additional inspection and testing as required for completion of permanent engine generator testing as specified in Section 26.3213.

E. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.4 CLEANING

A. See Section 01.7419 - Construction Waste Management and Disposal for additional requirements.

B. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.5 CLOSEOUT ACTIVITIES

A. See Section 01.7800 - Closeout Submittals for closeout submittals.

B. See Section 01.7900 - Demonstration and Training for additional requirements.

C. Demonstration: Demonstrate proper operation of connection cabinets and associated power transfer systems to Owner, and correct deficiencies or make adjustments as directed.

D. Training: Train Owner's personnel on operation, adjustment, and maintenance of connection cabinets and associated power transfer systems.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of four hours of training.
3. Instructor: Manufacturer's authorized representative.
4. Location: At project site.

3.6 PROTECTION

A. Protect installed connection cabinets from subsequent construction operations.

END OF SECTION 26.3633

SECTION 26.4100 - FACILITY LIGHTNING PROTECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Strike (air) terminals and interconnecting conductors.

B. Grounding and bonding for lightning protection.

1.2 RELATED REQUIREMENTS

A. Section 26.0526 - Grounding and Bonding for Electrical Systems: Electrical system grounds.

B. Surge Protection for Wiring Systems: Specified in individual system requirements.

C. Section _____: Ground connections for metal communications towers.

1.3 REFERENCE STANDARDS

A. NFPA 780 - Standard for the Installation of Lightning Protection Systems; 2026.

B. UL 96 - Lightning Protection Components; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination with Concrete Work: Coordinate embedding of lightning protection components in concrete.

B. Coordination with Roofing Work: Ensure adequate attachment of strike terminals and conductors without damage to roofing.

C. Preinstallation Meeting: Convene meeting at least at least two weeks prior to commencement of work affected by lightning protection system requirements to discuss prerequisites and coordination required by other installers; require attendance by representatives of installers whose work will be affected.

1.5 SUBMITTALS

A. See Section 01.3000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate location and layout of air terminals, grounding electrodes, and bonding connections to structure and other metal objects. Include terminal, electrode, and conductor sizes, and connection and termination details.

1. Where conductors or grounds are to be embedded or concealed in other construction, submit shop drawings at least 30 days prior to start of construction.
2. If concrete-encased grounds are to be used and are not shown in Contract Documents, provide sufficient data to determine concrete encasement dimensions and location.
3. Include data on actual ground resistance determined by field measurement in accordance with NFPA 780.
4. Include engineering analysis of equalization of potential to metal bodies within structure.
5. Include access panels, test holes, and disconnecting means for maintenance.

C. Product Data: Provide dimensions and materials of each component, indication of testing agency listing, and installation instructions.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Installation Certification: Submit copy of certification agency's approval.

F. Operation and Maintenance Data: Provide recommended inspection and testing plan, including recommended intervals, to achieve periodic maintenance as recommended in NFPA 780; provide customized plan reflecting actual installation configuration with specific installed components identified.

G. Project Record Documents: Record actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors in project record documents.

1.6 QUALITY ASSURANCE

A. Maintain one copy of each referenced system design standard on site.

B. Manufacturer Qualifications: Company specializing in lightning protection equipment with minimum three years documented experience.

C. Designer Qualifications: Person or entity, employed by installer, who specializes in lightning protection system design with minimum three years documented experience.

D. Installer Qualifications: Capable of providing specified certification of installed system.

E. Products: Listed, classified, and labeled as suitable for purpose intended.

F. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Lightning Protection Components:

1. allG Fabrication; _____: www.allgfab.com/#sle.
2. Harger Lightning and Grounding; _____: www.harger.com/#sle.
3. National Lightning Protection Corporation; _____: www.theprotectionsource.com/#sle.
4. nVent ERICO; System 2000: www.nvent.com/#sle.
5. Robbins Lightning, Inc; _____: www.robbinslightning.com/#sle.
6. thermOweld, subsidiary of Continental Industries; division of Burndy LLC; _____: www.thermoweld.com/#sle.
7. Substitutions: See Section 01.6000 - Product Requirements.

2.2 LIGHTNING PROTECTION SYSTEM

A. Lightning Protection System: Provide complete system complying with NFPA 780, including air terminals, bonding, interconnecting conductors and grounding electrodes.

1. Provide system that protects:
   a. Entire structure.
   b. Open air areas within 100 feet of exterior walls at grade level.
   c. Open air areas within building footprint.

d. Metal communications towers (grounding only).

2. Coordinate with other grounding and bonding systems specified.
3. Treat isolated non-grounded protruding metal items as specified by NFPA 780 for heavy-duty stacks.
4. Determine ground resistance by field measurement.
5. Provide copper, bronze, or stainless steel components, except where aluminum is allowed by NFPA 780.
6. Provide disconnecting means and access panels or similar devices to allow complete periodic inspection and testing as described by NFPA 780 Annex D.
7. Provide system certified by Underwriters Laboratories or Lightning Protection Institute.

B. Strike Terminals: Provide strike (air) terminals on the following:

1. Roofs.
2. Penthouse roofs.
3. Parapets.
4. Roof mounted equipment.
5. Stacks.
6. Chimneys.
7. Generators.

2.3 COMPONENTS

A. All Components: Complying with applicable requirements of UL 96.

B. Strike (Air) Terminals: Copper, solid, with adhesive bases for single-ply roof installations.

C. Grounding Rods: Solid copper.

D. Ground Plate: Copper.

E. Conductors: Copper cable.

F. Connectors and Splicers: Bronze.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated on shop drawings.

B. Coordinate work with installation of roofing and exterior and interior finishes.

3.2 INSTALLATION

A. Install in accordance with referenced system standards and as required for specified certification.

B. Connect conductors using mechanical connectors or exothermic welding process; protect adjacent construction elements and finishes from damage.

3.3 FIELD QUALITY CONTROL

A. See Section 01.4000 - Quality Requirements for additional requirements.

B. Perform visual inspection as specified in NFPA 780 as if this were a periodic follow-up inspection.

C. Perform continuity testing as specified in NFPA 780 as if this were testing for periodic maintenance.

D. Obtain services of specified certification agency to provide inspection and certification of lightning protection system, including performance of other testing required by that agency.

END OF SECTION 26.4100

SECTION 26.4300 - SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surge protective devices for service entrance locations.

B. Surge protective devices for distribution locations.

C. Surge protective devices for branch panelboard locations.

1.2 RELATED REQUIREMENTS

A. Section 26.0526 - Grounding and Bonding for Electrical Systems.

B. Section 26.2300 - Low-Voltage Switchgear.

C. Section 26.2413 - Switchboards.

D. Section 26.2416 - Panelboards.

E. Section 27.1000 - Structured Cabling: Protectors for communications service entrance.

1.3 ABBREVIATIONS AND ACRONYMS

A. EMI/RFI: Electromagnetic Interference/Radio Frequency Interference.

B. SPD: Surge Protective Device.

1.4 REFERENCE STANDARDS

A. MIL-STD-220 - Method of Insertion Loss Measurement; 2009c (Validated 2024).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 1283 - Standard for Electromagnetic Interference Filters; Current Edition, Including All Revisions.

G. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

1.5 SUBMITTALS

A. See Section 01.3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.

1. SPDs with EMI/RFI filter: Include noise attenuation performance.

C. Shop Drawings: Include wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.

D. Certificates: Manufacturer's documentation of listing for compliance with the following standards:

1. UL 1449.
2. UL 1283 (for Type 2 SPDs).

E. Field Quality Control Test Reports.

F. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Operation and Maintenance Data: Include information on status indicators and recommended maintenance procedures and intervals.

H. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

I. Project Record Documents: Record actual connections and locations of surge protective devices.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in accordance with manufacturer's written instructions.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

A. See Section 01.7800 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer's Warranty: Provide minimum five year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.

C. Exclude surge protective devices from any clause limiting warranty responsibility for acts of nature, including lightning, stated elsewhere.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Field-Installed, Externally Mounted Surge Protective Devices:

1. ABB: www.electrification.us.abb.com/#sle.
2. Intermatic, Inc: www.intermatic.com/#sle.
3. nVent ERICO: www.nvent.com/#sle.
4. Schneider Electric: www.se.com/#sle.
5. Surge Suppression, LLC (SSI): www.surgesuppression.com/#sle.
6. Leviton.

B. Factory-installed, Internally Mounted Surge Protective Devices:

1. Same as manufacturer of equipment containing surge protective device, to provide complete listed assembly including SPD.

C. Substitutions: See Section 01.6000 - Product Requirements.

D. Source Limitations: Provide surge protective devices produced by single manufacturer and obtained from single supplier.

2.2 SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS

A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings.

B. Unless otherwise indicated, provide field-installed, externally-mounted or factory-installed, internally-mouonted SPDs.

C. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.

D. Protected Modes:

1. Wye Systems: L-N, L-G, N-G, L-L.

E. UL 1449 Voltage Protection Ratings (VPRs):

1. Equivalent to basis of design.
2. 208Y/120V System Voltage: Not more than 1,000 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.

F. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.

G. Enclosure Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:

1. Indoor clean, dry locations: Type 1.
2. Outdoor locations: Type 3R.

H. Mounting for Field-installed, Externally Mounted SPDs: Unless otherwise indicated, as specified for the following locations:

1. Provide surface-mounted SPD where mounted in non-public areas or adjacent to surface-mounted equipment.
2. Provide flush-mounted SPD where mounted in public areas or adjacent to flush-mounted equipment.

I. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.

1. Switchgear: See Section 26.2300.
2. Switchboards: See Section 26.2413.
3. Panelboards: See Section 26.2416.

2.3 SURGE PROTECTIVE DEVICES FOR SERVICE ENTRANCE LOCATIONS

A. Surge Protective Device:

1. Protection Circuits: Field-replaceable modular or non-modular.
2. Surge Current Rating: Not less than 240 kA per mode/480 kA per phase.
3. Repetitive Surge Current Capacity: Not less than 5,000 impulses.
4. UL 1449 Nominal Discharge Current (I-n): 20 kA.
5. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
6. EMI/RFI Filtering: Provide EMI/RFI filter to attenuate electrical noise; listed as complying with UL 1283 for Type 2 SPDs (UL 1283 listing not available for Type 1 SPDs).
    a. Noise Attenuation: Not less than 40 dB at 100 kHz using MIL-STD-220 insertion loss test method.
7. Diagnostics:
    a. Protection Status Monitoring: Provide indicator lights to report the protection for each phase.
    b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
    c. Remote Status Monitoring: Provide Form C dry type contacts (normally open and normally closed) for remote annunciation of status.
8. Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch or not direct bus connected.

2.4 SURGE PROTECTIVE DEVICES FOR DISTRIBUTION LOCATIONS

A. Distribution locations include SPDs connected to distribution panelboards.

B. Surge Protective Device:

1. Protection Circuits: Field-replaceable modular or non-modular.
2. Surge Current Rating: Not less than 120 kA per mode/240 kA per phase.
3. Repetitive Surge Current Capacity: Not less than 3,500 impulses.
4. UL 1449 Nominal Discharge Current (I-n): 20 kA.

5. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
6. EMI/RFI Filtering: Provide EMI/RFI filter to attenuate electrical noise; listed as complying with UL 1283 for Type 2 SPDs (UL 1283 listing not available for Type 1 SPDs).
    a. Noise Attenuation: Not less than 40 dB at 100 kHz using MIL-STD-220 insertion loss test method.
7. Diagnostics:
    a. Protection Status Monitoring: Provide indicator lights to report the protection status for each phase.
    b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
    c. Remote Status Monitoring: Provide Form C dry type contacts (normally open and normally closed) for remote annunciation of status.
    d. Surge Counter: Provide surge event counter with manual reset button, surge count retention upon power loss, and six digit LCD display that indicates quantity of surge events.
8. Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch or not direct bus connected.

2.5 SURGE PROTECTIVE DEVICES FOR BRANCH PANELBOARD LOCATIONS

A. Surge Protective Device:

1. Protection Circuits: Field-replaceable modular or non-modular.
2. Surge Current Rating: Not less than 60 kA per mode/120 kA per phase.
3. Repetitive Surge Current Capacity: Not less than 2,000 impulses.
4. UL 1449 Nominal Discharge Current (I-n): 20 kA.
5. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
6. EMI/RFI Filtering: Provide EMI/RFI filter to attenuate electrical noise; listed as complying with UL 1283 for Type 2 SPDs (UL 1283 listing not available for Type 1 SPDs).
    a. Noise Attenuation: Not less than 40 dB at 100 kHz using MIL-STD-220 insertion loss test method.
7. Diagnostics:
    a. Protection Status Monitoring: Provide indicator lights to report the protection status for each phase.
    b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
    c. Remote Status Monitoring: Provide Form C dry type contacts (normally open and normally closed) for remote annunciation of status.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.

C. Verify that electrical equipment is ready to accept connection of the SPD and that installed overcurrent device is consistent with requirements of drawings and manufacturer's instructions.

D. Verify system grounding and bonding is in accordance with Section 26.0526, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Unless indicated otherwise, connect service entrance surge protective device on load side of service disconnect main overcurrent device.

E. Provide conductors with minimum ampacity as indicated on the drawings, as required by NFPA 70, and not less than manufacturer's recommended minimum conductor size.

F. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be reasonably rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.

G. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 26.0526 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.

H. Disconnect SPD prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPD connected.

3.3 FIELD QUALITY CONTROL

A. See Section 01.4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS Section 7.19.1.

D. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

3.4 CLEANING

A. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26.4300

SECTION 26.5100 - INTERIOR LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interior luminaires.

B. Exit signs.

C. Ballasts and drivers.

1.2 RELATED REQUIREMENTS

A. Section 26.0529 - Hangers and Supports for Electrical Systems.

B. Section 26.0533.16 - Boxes for Electrical Systems.

C. Section 26.0548 - Vibration and Seismic Controls for Electrical Systems.

D. Section 26.0553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26.0923 - Lighting Control Devices.

F. Section 26.2726 - Wiring Devices: Manual wall switches and wall dimmers.

G. Section 26.5600 - Exterior Lighting.

1.3 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

C. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).

D. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information; 2019 (Reaffirmed 2025).

E. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2024.

F. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

H. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2025.

I. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

J. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2023.

K. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2023.

L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. UL 844 - Luminaires for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

O. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

P. UL 1598 - Luminaires; Current Edition, Including All Revisions.

Q. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.5 SUBMITTALS

A. See Section 01.3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:

1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
2. Provide photometric calculations where luminaires are proposed for substitution.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

1. LED Luminaires:
   a. Include estimated useful life, calculated based on IES LM-80 test data.
   b. Include IES LM-79 test report upon request.
2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.
3. Ballasts: Include wiring diagrams and list of compatible lamp configurations.

4. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.

D. Samples:

1. Provide one sample(s) of each specified luminaire upon request.
2. Provide one sample(s) of each luminaire proposed for substitution upon request.

E. Field quality control reports.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01.6000 - Product Requirements, for additional provisions.

I. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

A. See Section 01.7800 - Closeout Submittals, for additional warranty requirements.

B. Provide 5-year manufacturer warranty for LED luminaires, including drivers.

PART 2 PRODUCTS

2.1 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Substitutions: See Section 01.6000 - Product Requirements.

2.2 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Recessed Luminaires:

1. Ceiling Compatibility: Comply with NEMA LE 4.
2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

H. Hazardous (Classified) Location Luminaires: Listed and labeled as complying with UL 844 for the classification of the installed location.

I. LED Luminaires:

1. Components: UL 8750 recognized or listed as applicable.
2. Tested in accordance with IES LM-79 and IES LM-80.
3. LED Estimated Useful Life: Minimum of 60,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

J. LED Tape Lighting Systems: Provide all power supplies, drivers, cables, connectors, channels, covers, mounting accessories, and interfaces as necessary to complete installation.

1. LED Tape - General Requirements:
   a. Listed.
   b. Designed for field cutting in accordance with listing.
   c. Wet Location Applications: IEC 60529, IP 68 (waterproof) rated.

K. Track Lighting Systems: Provide track compatible with specified track heads, with all connectors, power feed fittings, dead ends, hangers and canopies as necessary to complete installation.

L. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

2.3 EXIT SIGNS

A. Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.

1. Number of Faces: Single- or double-face as indicated or as required for installed location.
2. Directional Arrows: As indicated or as required for installed location.

B. Powered Exit Signs: Internally illuminated with LEDs unless otherwise indicated.

2.4 BALLASTS AND DRIVERS

A. Ballasts/Drivers - General Requirements:

1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
3. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.

B. Dimmable LED Drivers:

1. Dimming Range: Continuous dimming from 100 percent to one percent relative light output unless dimming capability to lower level is indicated, without flicker.
2. Control Compatibility: Fully compatible with the dimming controls to be installed.
   a. Wall Dimmers: See Section 26.2726.
   b. Daylighting Controls: See Section 26.0923.

2.5 ACCESSORIES

A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.

B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

C. Wire Rope Hanging Systems for Suspended Luminaires: Zinc-plated steel, selected in accordance with manufacturer's application criteria as required for load with minimum safety factor of _____.

D. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

E. Architectural Trims for LED Lighting:

1. Description: Trims designed for integration into architectural elements, with channels to accommodate LED tape lighting system.
2. Material: Extruded aluminum, ASTM B221 ASTM B221M 6063 alloy, T5 temper.
3. Profile: As indicated on drawings.
4. Finish: As indicated on drawings.
5. Provide accessory lenses for LED channels.

F. Fire-Rated Luminaire Enclosures:

1. Provide as required to preserve fire resistance rating of building elements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26.0533.16 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

E. Provide required support and attachment in accordance with Section 26.0529.

F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

G. Suspended Ceiling Mounted Luminaires:

1. Do not use ceiling tiles to bear weight of luminaires.
2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
3. Secure surface-mounted and recessed luminaires to building structure.
4. Secure pendant-mounted luminaires to building structure.
5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gauge, connected from opposing corners of each recessed luminaire to building structure.
7. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

H. Recessed Luminaires:

1. Install trims tight to mounting surface with no visible light leakage.
2. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

I. Suspended Luminaires:

1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
3. Provide minimum of two supports for each luminaire, with no more than 8 feet between supports.
4. Install canopies tight to mounting surface.
5. Unless otherwise indicated, support pendants from swivel hangers.

J. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to bottom of luminaire.

K. Install accessories furnished with each luminaire.

L. Bond products and metal accessories to branch circuit equipment grounding conductor.

M. Exit Signs:

1. Unless otherwise indicated, connect unit to unswitched power. Bypass local switches, contactors, or other lighting controls.
2. Install lock-on device on branch circuit breaker serving units.

N. Install lamps in each luminaire.

3.4 FIELD QUALITY CONTROL

A. See Section 01.4000 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.5 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.6 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.7 CLOSEOUT ACTIVITIES

A. See Section 01.7800 - Closeout Submittals, for closeout submittals.

B. See Section 01.7900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

3.8 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 26.5100

SECTION 26.5600 - EXTERIOR LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Exterior luminaires.

B. Ballasts.

C. Poles and accessories.

D. Luminaire accessories.

1.2 RELATED REQUIREMENTS

A. Section 03.3000 - Cast-in-Place Concrete: Materials and installation requirements for concrete bases for poles.

B. Section 26.0526 - Grounding and Bonding for Electrical Systems.

C. Section 26.0529 - Hangers and Supports for Electrical Systems.

D. Section 26.0533.16 - Boxes for Electrical Systems.

E. Section 26.0548 - Vibration and Seismic Controls for Electrical Systems.

F. Section 26.0923 - Lighting Control Devices.

G. Section 26.2726 - Wiring Devices: Receptacles for installation in poles.

H. Section 26.2813 - Fuses.

I. Section 26.5100 - Interior Lighting.

1.3 REFERENCE STANDARDS

A. AASHTO LTS - Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals; 2013, with Editorial Revision (2025).

B. IEEE C2 - National Electrical Safety Code(R) (NESC(R)); 2023.

C. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information; 2019 (Reaffirmed 2025).

D. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2024.

E. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.

F. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

G. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2000 (Reaffirmed 2006).

H. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2023.

I. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2023.

J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. UL 844 - Luminaires for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

L. UL 1598 - Luminaires; Current Edition, Including All Revisions.

M. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
2. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.5 SUBMITTALS

A. See Section 01.3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:

1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
2. Provide photometric calculations where luminaires are proposed for substitution upon request.
3. Provide structural calculations for each pole proposed for substitution.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.

1. LED Luminaires:
   a. Include estimated useful life, calculated based on IES LM-80 test data.
   b. Include IES LM-79 test report upon request.
2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.
3. Lamps: Include rated life and initial and mean lumen output.
4. Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed.

D. Sustainable Design Documentation: Submit manufacturer's product data on lamp mercury content and rated lamp life, showing compliance with specified requirements.

E. Samples:

1. Provide one sample(s) of each specified luminaire upon request.
2. Provide one sample(s) of each luminaire proposed for substitution upon request.

F. Certificates for Poles and Accessories: Manufacturer's documentation that products are suitable for the luminaires to be installed and comply with designated structural design criteria.

G. Field Quality Control Reports.

1. Include test report indicating measured illumination levels.

H. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

I. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01.6000 - Product Requirements, for additional provisions.
2. Touch-Up Paint: 2 gallons, to match color of pole finish.

K. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.8 WARRANTY

A. See Section 01.7800 - Closeout Submittals, for additional warranty requirements.

B. Provide 5-year manufacturer warranty for all LED luminaires, including drivers.

PART 2 PRODUCTS

2.1 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Substitutions: See Section 01.6000 - Product Requirements.

2.2 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

H. Recessed Luminaires:

1. Ceiling Compatibility: Comply with NEMA LE 4.
2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

I. Hazardous (Classified) Location Luminaires: Listed and labeled as complying with UL 844 for the classification of the installed location.

J. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

K. LED Luminaires:

1. Components: UL 8750 recognized or listed as applicable.
2. Tested in accordance with IES LM-79 and IES LM-80.
3. LED Estimated Useful Life: Minimum of 60,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.3 BALLASTS AND DRIVERS

A. Ballasts/Drivers - General Requirements:

1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
3. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.

B. Dimmable LED Drivers:

1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
2. Control Compatibility: Fully compatible with the dimming controls to be installed.

2.4 POLES

A. All Poles:

1. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.
2. Structural Design Criteria:
   a. Comply with AASHTO LTS.
   b. Wind Load: Include effective projected area (EPA) of luminaire(s) and associated supports and accessories to be installed.
3. Mounting: Install on concrete foundation, height as indicated on the drawings, unless otherwise indicated.
4. Unless otherwise indicated, provide with the following features/accessories:
   a. Top cap.
   b. Anchor bolts with leveling nuts or leveling shims.
   c. Anchor base cover.

B. Metal Poles: Provide ground lug, accessible from handhole or transformer base.

2.5 ACCESSORIES

A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.

B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26.0533.16 as required for installation of luminaires provided under this section.

B. Install products in accordance with manufacturer's instructions.

C. Install luminaires in accordance with NECA/IESNA 501.

D. Provide required support and attachment in accordance with Section 26.0529.

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. Recessed Luminaires:

1. Install trims tight to mounting surface with no visible light leakage.
2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

G. Suspended Luminaires:

1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet in length, with no more than 8 feet between supports.
4. Install canopies tight to mounting surface.
5. Unless otherwise indicated, support pendants from swivel hangers.

H. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to bottom of luminaire.

I. Pole-Mounted Luminaires:

1. Maintain the following minimum clearances:
   a. Comply with IEEE C2.
   b. Comply with utility company requirements.
2. Foundation-Mounted Poles:
   a. Install foundations plumb.
   b. Install poles plumb, using leveling nuts or shims as required to adjust to plumb.
   c. Tighten anchor bolt nuts to manufacturer's recommended torque.
   d. Install non-shrink grout between pole anchor base and concrete foundation, leaving small channel for condensation drainage.
   e. Install anchor base covers or anchor bolt covers as indicated.
3. Grounding:
   a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
   b. Provide supplementary ground rod electrode as specified in Section 26.0526 at each pole bonded to grounding system as indicated.
4. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.
5. Install non-breakaway in-line fuse holders and fuses complying with Section 26.2813 in pole handhole or transformer base for each ungrounded conductor.

J. Install accessories furnished with each luminaire.

K. Bond products and metal accessories to branch circuit equipment grounding conductor.

L. Install lamps in each luminaire.

3.4 FIELD QUALITY CONTROL

A. See Section 01.4000 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

E. Measure illumination levels at night with calibrated meters to verify compliance with performance requirements. Record test results in written report to be included with submittals.

3.5 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Luminaires with Field-Rotatable Optics: Position optics according to manufacturer's instructions to achieve lighting distribution as indicated or as directed by Architect.

3.6 CLEANING

A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.7 CLOSEOUT ACTIVITIES

A. See Section 01.7800 - Closeout Submittals, for closeout submittals.

B. See Section 01.7900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

3.8 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 26.5600

SECTION 26.5613 - LIGHTING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Furnish style light fixtures as indicated on the Drawings.

1.02 MATERIALS

A. Fasteners

All fasteners shall be non-ferrous to prevent corrosion and ensure longer life.

1.03 OPTICAL ASSEMBLY

A. As indicated on the Drawings for each lighting fixture.

1.04 ELECTRICAL ASSEMBLY

A. All selected components shall be UL recognized and be an integral part of the fixture. The fixture will carry a UL, cUL label and will be suitable for wet locations. Socket will include, nickel plated screw shell with center contact.

1.05 BALLASTS

A. All ballasts are regulating with power factors better than 90% (HPF). Ballast shall provide +/- 5% lamp power regulation with +/- 10% input voltage regulation. Ballasts are factory prewired and tested. Ballast shall be twist-lock type for easier serviceability.

1.06 FINISH

A. Thermoset polyester powdercoat, laboratory tested for superior weatherability and fade resistance in accordance with ASTM B-117-64 and ASNI/ASTM G53-77 specifications.

1.07 WARRANTY

A. Minimum three year limited warranty.

1.08 LAMP POST

A. As indicated on the Drawings for each lighting type.

1.09 FOUNDATION

A. As indicated on the Drawings and recommended by the manufacturer for each type of lighting fixture.

END OF SECTION

SECTION 27.1000 - STRUCTURED CABLING FOR VOICE AND DATA - OUTSIDE AND INSIDE PLANT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Telecommunications service entrance to building(s).

B. Cabling and pathways inside building(s).

C. Cabling and pathways connecting building(s).

D. Distribution frames, cross-connection equipment, enclosures, and outlets.

E. Grounding and bonding the telecommunications distribution system.

1.2 RELATED REQUIREMENTS

A. Section 337119 - Electrical Underground Ducts and Manholes.

B. Section 078400 - Firestopping.

C. Section 260526 - Grounding and Bonding for Electrical Systems: Electrical system grounding and bonding.

D. Section 260534 - Conduit.

E. Section 260536 - Cable Trays for Electrical Systems.

F. Section 260537 - Boxes.

G. Section 262726 - Wiring Devices.

1.3 REFERENCE STANDARDS

A. EIA-310 - Cabinets, Racks, Panels, and Associated Equipment; Electronic Industries Association; Revision D, 1992.

B. CEA-310 - Cabinets, Racks, Panels, and Associated Equipment; Consumer Electronics Association; Revision E, 2005.

C. ICEA S-90-661 - Category 3, 5, 5e, 6 and 6A Individually Unshielded Twisted Pair Indoor Cable for Use in General Purpose and LAN Communications Wiring Systems; Insulated Cable Engineers Association; 2002.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. TIA-455-21 - FOTP-21 - Mating Durability of Fiber Optic Interconnecting Devices; 2012.

F. TIA-492AAAB-A - Detail Specification for 50-um Core Diameter/125-um Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers; 2009.

G. TIA-492CAAA - Detail Specification for Class IVa Dispersion-Unshifted Single-Mode Optical Fibers; 1998 (R 2002).

H. TIA-526-7 - OFSTP-7 - Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant; 2002.

I. TIA-526-14 - OFSTP-14 - Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant; Rev B, 2010.

J. TIA/EIA-568-C.1 - Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements; Rev C, 2012; Addenda 1-7.

K. TIA/EIA-568-C.2 - Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted Pair Cabling Components; Rev C, 2012; Addenda 1-11.

L. TIA/EIA-568-C.3 - Commercial Building Telecommunications Cabling Standard - Part 3: Optical Fiber Cabling Components Standard, and Addendum 1 - Additional Transmission Performance Specifications for 50/125 um Optical Fiber Cables; Rev C, 2012; Addendum 1.

M. TIA-569 - Commercial Building Standard for Telecommunications Pathways and Spaces; 2012.

N. TIA-570 - Residential Telecommunications Infrastructure Standard; 2009.

O. TIA/EIA-606 - Administration Standard for the Telecommunications Infrastructure; Rev B, 2012.

P. ANSI/J-STD-607 - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications; Rev A, 2002.

Q. UL 444 - Communications Cables; Current Edition, Including All Revisions.

R. UL 497 - Standard for Protectors for Paired-Conductor Communications Circuits; Current Edition, Including All Revisions.

S. UL 1863 - Standard for Communications-Circuit Accessories; Current Edition, Including All Revisions.

T. USDA RUS 345-83 - Gas Tube Surge Arrestors (PE-80); US Department of Agriculture; 1982.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Storage and handling requirements and recommendations.

2. Installation methods.

C. Shop Drawings: Show compliance with requirements on isometric schematic diagram of network layout, showing cable routings, telecommunication closets, rack and enclosure layouts and locations, service entrance, and grounding, prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).

D. Manufacturer Qualifications.

E. Installer Qualifications.

F. Field Test Reports.

G. Project Record Documents: Prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).

1. Record actual locations of outlet boxes and distribution frames.
2. Show as-installed color coding, pair assignment, polarization, and cross-connect layout.
3. Identify distribution frames and equipment rooms by room number on contract drawings.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: At least 3 years' experience manufacturing products of the type specified.

B. Installer Qualifications: A company having at least 3 years' experience in the installation and testing of the type of system specified, and:

1. Employing a BICSI Registered Communications Distribution Designer (RCDD).
2. Supervisors and installers factory certified by manufacturers of products to be installed.
3. Employing experienced technicians for all work; show at least 3 years' experience in the installation of the type of system specified, with evidence from at least 2 projects that have been in use for at least 18 months; submit project name, address, and written certification by user.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Keep stored products clean and dry.

1.7 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a 15 week period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Cabling and Equipment:

B. Hubbell Premise Wiring

1. Substitutions:
   a. Systimax GigaSpeed solution, Not Uniprise
   b. Panduit Mini-Com with Panduit cable
   c. Leviton Berk-Tek
   d. See Section 260100 - Product Requirements.
   e. Cable and connectivity manufacturer must be the same.

2.2 SYSTEM DESIGN

A. Provide a complete permanent system of cabling and pathways for voice and data communications, including cables, conduits and wireways, pull wires, support structures, enclosures and cabinets, and outlets.

1. Comply with TIA/EIA-568 and TIA/EIA-569, latest editions.
2. Provide fixed cables and pathways that comply with NFPA 70 and ANSI/J-STD-607 and are UL listed or third party independent testing laboratory certified.
3. Provide connection devices that are rated for operation under conditions of 32 to 140 degrees F at relative humidity of 0 to 95 percent, noncondensing.
4. In this project, the term plenum is defined as return air spaces above ceilings, inside ducts, under raised floors, and other air-handling spaces.

B. Capacity:

1. Horizontal Cabling
   a. MDF to IDF's
      1) Armored 12 strand single mode (OS2) fiber optic Hubbell PN# HFCD150012PS, Armored 12-strand multi-mode (OM4) fiber optic Hubbell PN#HFCB150012P4, and 25-pair copper Mohawk PN#M58142.
      2) Number of outlets:
         (a) Classrooms: Refer to the drawings for exact counts of ports. Contractor shall calculate based on floor plans.
         (b) Refer to floor plans for Wi-Fi locations (4 drops per location).
         (c) Refer to floor plans for Camera locations (1 drops per interior location, 2 drops per exterior location).
         (c) Provide additional outlets where indicated on drawings.

C. Main Distribution Frame (MDF): MDF as support structure for terminating backbone cables, functioning as point of presence to external service provider.

1. Located as indicated on the drawings.
2. Capacity: As required to terminate all cables required by design criteria plus minimum 25 percent spare space.
3. Provide new 4-post racks. Hubbell PN# SF841948.
4. Provide cable management Hubbell PN#VME614C2 and Hubbell PN#HM24C
5. Provide (2) PDU's for each 2-post rack Tripplite# PDUMNV30LX
6. Provide Uninterruptible power Supply (UPS)Eaton PN# 9PX3000RT-L

D. Intermediate Distribution Frames (IDF): Support structures for terminating horizontal cables that extend to data and telecommunications outlets.

1. Locate intermediate distribution frames as indicated on the drawings.
2. Provide 4-post racks Hubbell PN#SF841936
3. Provide enclosed wall mounted racks where indicated. Hubbell cat#HSQ2436
4. Provide cable management Hubbell PN#VME677 and Hubbell PN#HM24C
5. Provide (2) PDU's for each 2-post rack Tripplite# PDUMNV30LX
6. Provide Uninterruptible power Supply (UPS)Eaton PN# 9PX3000RT-L

E. Backbone Cabling: Cabling, pathways, and terminal hardware connecting intermediate distribution frames (IDF's) with main distribution frame (MDF), wired in star topology with main distribution frame at center hub of star.

F. Cabling to Outlets: Specified horizontal cabling, wired in star topology to distribution frame located at center hub of star; also referred to as "links".

2.3 PATHWAYS

A. Conduit: As specified in Section 260534; provide pull cords in all conduit.

B. Cable Trays: As specified in Section 260536.

2.4 COPPER CABLE AND TERMINATIONS

A. Copper Horizontal Cable: TIA/EIA-568 Category 6A, (.260 OD) solid conductor unshielded twisted pair (UTP), 23 AWG, 100 ohm; 4 individually twisted pairs; covered with blue jacket and complying with all relevant parts of and addenda to latest edition of TIA/EIA-568 and UL 444.

1. In plenums, provide NFPA 70 type CMP plenum-rated cable, Hubbell PN#C6ASPDSB
2. Testing: Furnish factory reel tests.
3. Provide jacket colors as follows:
   a) Data: Blue
   b) Wireless: Yellow
   c) Access Control: Purple
   d) Video Surveillance: Green

e) Paging/Clock System: Orange

B. Copper Cable Terminations: Insulation displacement connection (IDC) type using appropriate tool; use screw connections only where specifically indicated.

C. Jacks and Connectors: RJ-45, angled, non-keyed, terminated with 110-style insulation displacement connectors; high impact thermoplastic housing; complying with same standard as specified horizontal cable and UL 1863. Hubbell PN# HJU6Axx

1. Performance: 500 mating cycles.
2. Voice and Data Jacks: 4-pair, pre-wired to T568A configuration, with color-coded indications for T568B configuration.

D. Copper Backbone Cable: TIA/EIA-568 Category 5e solid conductor unshielded twisted pair (UTP), 24 AWG, 100 ohm; 25 pair; covered with gray thermoplastic jacket and complying with all relevant parts of and addenda to latest editions of TIA/EIA-568 and ICEA S-90-661, and UL 444. Cable shall be Mohawk #M58142. Terminate copper backbone cables on Cat 5e patch panels in the network rack.

1. In plenums, provide NFPA 70 type CMP plenum-rated cable.
2. Provide cable having conductors twisted at minimum rate of two per foot; actual length and frequency of twists at manufacturer's option.
3. Color code conductors in accordance with ICEA S-90-661.
4. Testing: Furnish factory reel tests.

2.5 FIBER OPTIC CABLE AND ADAPTORS

A. Fiber Optic Backbone Cable:

1. 12-fiber, Armored OS2 single mode 8/125 um, complying with TIA-492CAAA; covered with yellow cable jacket and complying with relevant portions of and addenda to latest edition of TIA/EIA-568. PN#HFCD10xxPS
2. 12-fiber, armored OM4 multimode 50/125 um, complying with TIA-492AAAB; covered with aqua cable jacket and complying with relevant portions of and addenda to latest edition of TIA/EIA-568. PN#HFCD1012P5

B. Fiber Patch Cords shall be part #DFHPCLCLCS3SM and DFHPCLCLCF3MM, 3 meter length.

C. Fiber Enclosures shall be Hubbell #FCR2U9SPX, with FSPNLCDS6 Duplex MM Adapter Panels, #FCLC900K50GM12 & FCLC900KSM12 SM and MM connectors.

D. Fiber Optic Adapters and Connectors: Duplex LC, push-on-push-off type, multimode adaptors with zirconia ceramic alignment sleeves; complying with relevant parts and addenda to latest edition of TIA/EIA-568 and with maximum attenuation of 0.3 dB at 1300 nm with less than 0.2 dB change after 500 mating cycles when tested in accordance with TIA-455-21.

2.6 CROSS-CONNECTION EQUIPMENT

A. Connector Blocks for Category 6A and Up Cabling: Type 110 insulation displacement connectors; capacity sufficient for cables to be terminated plus 25 percent spare.

B. Patch Panels for Copper Cabling: Sized to fit EIA standard 19 inch wide equipment racks; 0.09 inch thick aluminum; cabling terminated on Type 110 insulation displacement connectors; printed circuit board interface. Provide Hubbell #HPJ6A48, Comes with Rear management bar

1. Jacks: Non-keyed RJ-45, suitable for and complying with same standard as cable to be terminated; maximum 48 ports per standard width panel.
2. Capacity: Provide ports sufficient for cables to be terminated plus 25 percent spare.
3. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA/EIA-606 using encoded identifiers.
4. Provide incoming cable strain relief and routing guides on back of panel.
5. Patch Cords: Provide one patch cord for each pair of patch panel ports.
   a. Patch Cords shall be Hubbell #HC6Axxyy ten feet in length.
6. Manufacturer's patch cords must be used to provide a Channel Warranty
7. Category 6A panels shall meet or exceed Category 6A transmission requirements for connecting hardware, as specified in ANSI/TIA/EIA-568.2-D, Transmission Performance specifications for 4-pair 100 OHM cat 6A cabling systems
8. Panels shall be tested to 150% of IEEE 802.3bt DTE Power specification with no degradation of performance or materials
9. Stainless steel face plates must be used. Hubbell SSFL series

C. Patch Panels for Fiber Optic Cabling: Sized to fit EIA standard 19 inch wide equipment racks; 0.09 inch thick aluminum.

1. Adaptors: As specified above under FIBER OPTIC CABLING; maximum of 24 duplex adaptors per standard panel width.
2. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA/EIA-606 using encoded identifiers.
3. Provide incoming cable strain relief and routing guides on back of panel.
4. Provide rear cable management tray at least 8 inches deep with removable cover.
5. Provide dust covers for unused adaptors.
6. Patch Cords: Provide one patch cord for each pair of patch panel ports.

2.7 ENCLOSURES

A. Backboards: Interior grade plywood without voids, 3/4 inch thick; UL-labeled fire-retardant.

1. Size: 96 inches wide by 96 inches high.
2. Do not paint over UL label.

B. Server Cabinets: CEA-310 standard 700-millimeter-wide component racks.

1. Floor Mounted Cabinet: 16 gauge steel construction with corrosion resistant finish; vertical and horizontal cable management channels, top and bottom cable troughs, PDU channel, and grounding lug. Provide Hubbell PN# HCC423240BK
2. Provide Vertical and HZ cable management PN# HCC42UVCMBK Horizontal PN#HM24C.

C. Equipment Racks and Cabinets: CEA-310 standard 19 inch wide component racks.

1. Floor Mounted Racks: 16 gage steel construction with corrosion resistant finish; vertical and horizontal cable management channels, top and bottom cable troughs, and grounding lug. Provide Hubbell PN#SF841942 with PN#VME67, Horizontal managers PN#HM24C

D. Building Entrance Protector: Factory fabricated panel to connect incoming cable and interior cable to protector modules.

1. Capacity: One protector module per pair in incoming cable.
2. Protector Modules: Type rated for the application.
   a. Solid State Type: Complying with UL 497.
3. Incoming Side: Provide connector blocks of type specified.
4. Outgoing Side (to Interior): Backbone cable wired to connector blocks.

E. Outlet Boxes: For flush mounting in walls; depth as required to accommodate cable manufacturer's recommended minimum conductor bend radius.

1. Size, Unless Otherwise Indicated: 4 inches square by 2-1/8 inches deep.
2. Wall-Mounted Telephones: 4 inches high by 2 inches wide by 2-1/8 inches deep.
3. Wall Plates: Material and finish to match wiring device and wall plate finishes specified in Section 262726, complying with system design standards and UL 514C.
4. Faceplates: Stainless Steel, complying with system design standards and UL 514C.
5. Labels: Comply with TIA/EIA-606 using encoded identifiers; label each jack on the face plate as to its function with a unique numerical identifier.

2.7 POWER DISTRIBUTION UNIT (PDU)

A. Equipment Racks and Enclosures: Tripplite# PDUMNV30LX
Tripp Lite Monitored PDU Vertical Mount TAA

1. Single Phase, 120V 2.9kW
2. **Input: L5-30P 10ft**
3. Output: (24)5-15/20R
4. Dims: 70"H x 2.19"W x 1.75"

2.8 UNINTERRUPTIBLE POWER SUPPLY (UPS)

A. Provide Uninterruptible power Supply (UPS)Eaton PN# 9PX3000RT-L

1. Eaton 9PX Lithium Ion Series
2. Single Phase Online Rack/Tower UPS
3. 3000VA/2700W, 120V, 50/60Hz
4. L5-30P input line cord, 8ft
5. (6) 5-20R, (1**) L5-30R output receptacles**
6. 10.2 minutes internal runtime at full load
7. 4-post rail kit included
8. Provide Network Card
9. Dims: 3.4"H x 17.3"W x 23.8"D each
10. Weight: 53 lbs each

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

A. Comply with latest editions and addenda of TIA/EIA-568, TIA/EIA-569, ANSI/J-STD-607, NFPA 70, and SYSTEM DESIGN as specified in PART 2.

B. Comply with latest editions and addenda of TIA-570, ANSI/J-STD-607, NFPA 70, and SYSTEM DESIGN as specified in PART 2.

3.2 PATHWAYS

A. Install with the following minimum clearances:

1. 48 inches from motors, generators, frequency converters, transformers, x-ray equipment, and uninterruptible power systems.
2. 12 inches from power conduits and cables and panelboards.
3. 5 inches from fluorescent and high frequency lighting fixtures.
4. 6 inches from flues, hot water pipes, and steam pipes.

B. Conduit:

1. Do not install more than 2 (two) 90 degree bends in a single horizontal cable run.
2. Leave pull cords in place where cables are not initially installed.
3. Conceal conduit under floor slabs and within finished walls, ceilings, and floors except where specifically indicated to be exposed.
    a. Conduit may remain exposed to view in mechanical rooms, electrical rooms, and telecommunications rooms.
    b. Treat conduit in crawl spaces and under floor slabs as if exposed to view.
    c. Where exposed to view, install parallel with or at right angles to ceilings, walls, and structural members.

    d. Under floor slabs, locate conduit at 12 inches, minimum, below vapor retarder; seal penetrations of vapor retarder around conduit.

C. Outlet Boxes:

1. Coordinate locations of outlet boxes provided under Section 260537 as required for installation of telecommunications outlets provided under this section.
   a. Mounting Heights: Unless otherwise indicated, as follows:
      1) Telephone and Data Outlets: 18 inches above finished floor.
      2) Telephone Outlets for Side-Reach Wall-Mounted Telephones: 54 inches above finished floor to top of telephone.
      3) Telephone Outlets for Forward-Reach Wall-Mounted Telephones: 48 inches above finished floor to top of telephone.
   b. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
   c. Provide minimum of 24 inches horizontal separation between flush mounted outlet boxes installed on opposite sides of fire rated walls.

D. Grounding and Bonding: Perform in accordance with ANSI/J-STD-607 and NFPA 70.

E. Firestopping: Seal openings around pathway penetrations through fire-rated walls, partitions, floors, and ceilings in accordance with Section 078400.

3.3 INSTALLATION OF EQUIPMENT AND CABLING

A. Cabling:

1. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair use bend radius of not less than 4 times cable diameter.
2. Do not over-cinch or crush cables.
3. Do not exceed manufacturer's recommended cable pull tension.
4. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.

B. Service Loops (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly:

1. At Distribution Frames: 120 inches.
2. At Outlets - Copper: 12 inches.
3. At Outlets - Optical Fiber: 39 inches.

C. Copper Cabling:

1. Category 5e/6: Maintain cable geometry; do not untwist more than 1/2 inch from point of termination.
2. For 4-pair cables in conduit, do not exceed 25 pounds pull tension.
3. Copper Cabling Not in Conduit: Use only type CMP plenum-rated cable as specified.

D. Fiber Optic Cabling:

1. Prepare for pulling by cutting outer jacket for 10 inches from end, leaving strength members exposed. Twist strength members together and attach to pulling eye.

2. Support vertical cable at intervals as recommended by manufacturer.

E. Floor-Mounted Racks and Enclosures: Permanently anchor to floor in accordance with manufacturer's recommendations.

F. Field-Installed Labels: Comply with TIA/EIA-606 using encoded identifiers.

1. Cables: Install color coded labels on both ends.
2. Outlets: Label each jack on its face plate as to its type and function, with a unique numerical identifier.
3. Patch Panels: Label each jack as to its type and function, with a unique numerical identifier.
4. Patch Cords: Label with jack identifier corresponding to initial installation.

3.4 FIELD QUALITY CONTROL

A. Comply with inspection and testing requirements of specified installation standards.

B. Visual Inspection:
1. Inspect cable jackets for certification markings.
2. Inspect cable terminations for color coded labels of proper type.
3. Inspect outlet plates and patch panels for complete labels.
4. Inspect patch cords for complete labels.

3.5 FINAL TESTING AND INSPECTION

A. Provide testing in accordance with ANSI/TIA/EIA-568-C.1.

B. Cable Test: Provide prior to substantial completion, a Performance Evaluation Report, which will contain the following:

1. Cable Test: List by cable number each UTP Cable in the project, which details:
   a. UTP Cables:
      1) Cable ID Number
      2) List continuity, reversal, open, shorts and miswires
      3) Category performance
      4) List other discrepancies with the UTP installation (bad terminations, faulty labeling, etc).
      5) Tester printout for each cable.
2. UTP Cable Testing: Test each cable pair of each cable after installation for Specified Category performance. Conduct test with a tester designed for testing above cable (with RJ-45 jacks installed) from each data outlet to associated patch cord through +0 panel jack (Channel). Provide printout for each test as part of the Performance Evaluation Report. Minimum performance categories for report are to be as follows:
   a. Wire Map/Continuity
   b. Length
   c. Near End Crosstalk (pair to pair) NEXT
   d. Near End Crosstalk (power sum) PSNEXT

e. Equal Level Far-End Crosstalk Loss (pair to pair) ELFEXT
f. Equal Level Far-End Crosstalk Loss (power sum) PSELFEXT
g. Return Loss
h. Attenuation
i. Propogation Delay
j. Delay Skew
k. PSACR (Powersum Attenuation – Crosstalk Ratio)

3. System Performance Report: Provide a narrative detailing the system as a whole, in regard to the quality of installation and any discrepancies affecting performance. This narrative to indicate a summary of the above Cable Test, as well as an accurate summary of specified Category performance as well as capability of the cabling system to perform at specified Category bandwidth.

3.6 WARRANTY

A. The installation shall be provided with a minimum 25-year **CHANNEL** warranty for strict compliance with the performance requirements of ANSI/TIA/EIA-568-C.1 to support and conform to ANSI/TIA/EIA-568-C.1 specifications covering any current or future application which supports transmission over a properly constructed horizontal cabling system premises network which meets the channel performance as described in ANSI/TIA/EIA-568-C.2.

END OF SECTION 27.1000

SECTION 27.4100 - FITNESS AND DAY ROOM SOUND SYSTEMS

PART 1 GENERAL

1.1 WORK INCLUDED

A. The Electrical Contractor, as part of this section, shall provide, install and test a complete sound reinforcement system as specified herein for areas indicated on the drawings.

B. The Electrical Contractor shall furnish all conduit, wire, connectors, hardware and other incidental items necessary for the complete and proper operation of the sound reinforcement system.

1.2 SUBMITTALS

A. Submit the following in accordance with Conditions of Contracts and Division 1 specifications sections:

B. Audio functional drawings for each system

C. Rack elevations

D. Loudspeaker mounting details

E. Conduit riser

F. AV plate details

G. Cable pull schedule

H. Manufacturer equipment specification sheets

1.3 QUALIFICATIONS OF BIDDERS

A. The bidder shall be a firm with a minimum of 5 years of experience in the fabrication, assembly, and installation of audio systems of similar magnitude and quality as specified in these documents, and shall submit documentation to this effect with the bid return.

B. The bidder shall be I.C.I.A / A.V.S.P certified.

1.4 ALTERNATE EQUIPMENT

A. This equipment was selected to establish a standard of quality and performance. The contractor may offer substitutes for approval but the burden of proof of equality shall be with the contractor.

B. Pre-approval submittals shall contain a component-by-component comparison of all specification lines. Differences shall be clearly high-lited with

C. The contractor shall provide any additional documentation, samples, or performance tests required by the Engineer in order to establish proof of equality with the specified equipment.

D. All substitutions shall provide equal of greater system performance and function. No substitute equipment shall be purchased or installed without approval by the Engineer.

E. Final approval of the substituted equipment shall be given after the system has been installed. Failure to meet the specification, as determined by the Engineer, shall result in the removal of the substituted equipment and the installation of the specified equipment without any additional cost to the owner.

F. When a piece of specified equipment has been discontinued by the manufacturer or is unavailable due to lack of inventory, the contractor may substitute the *manufacturers recommended* replacement without notice to the Engineer. If a piece of equipment is not replaced by a newer model with the same or better features and a different manufacturer can supply a piece of equipment that meets or exceeds the original specified equipment, the contractor shall notify the Engineer and submit the equipment cut sheets for approval.

1.5 EXCEPTIONS

A. Any and all exceptions to these specifications and related drawings must be made with the submission of the bid. In the absence of exceptions, the specifications and related drawings shall be binding in letter and intent on the successful bidder. It will also be understood that the bidder has examined the design and specifications in detail, and is prepared to take full responsibility for the performance of the complete installation as designed and specified.

1.6 SUB-CONTRACT INFORMATION

A. Any and all sub-contractors that a bidder plans to utilize for this project are to be listed with the references and qualifications in the bid submission. The successful bidder shall supervise all sub-contract work. Any and all sub-contract work is the complete and sole responsibility of the contractor.

1.7 SPECIFICATION INFORMATION REQUESTS AND QUESTIONS

A. Any requests for clarification shall be submitted to Mr. DJ Seibert of Snyder Hoffman Associates, 1005 West Lehigh Street, Bethlehem, PA, 18018, 610-694-8020, dseibert@snyderhoffman.com. All requests are to be made in writing and submitted no later than ten days prior to bid submission.

1.8 CERTIFICATIONS AND REPRESENTATIONS

A. Quality of materials: All equipment items and installation materials will be new. No previously owned, demonstrated or otherwise used items will be provided. Note that prior to equipment installation and on-site integration, all equipment items shall be performance tested and quality checked to insure full functionality of each equipment item.

B. Tax Statement Certification: The contractor certifies that all local, state, and federal taxes are separately listed in any price quotations.

1.9 QUALITY ASSURANCE

A. All equipment and materials provided for this contract are to be new and shall meet or exceed the latest published specification of the manufacturer for that item.

B. All equipment shall be UL listed or equivalent.

1.10 NOT IN CONTRACT

A. Some equipment related to the audio system will be provided under the Electrical Contract. Unless otherwise indicated in these specifications or related drawings, these will include the following:

1. All electrical breaker / load panels.
2. Receptacles / switches.

PART 2 PRODUCTS

2.1 EQUIPMENT DESCRIPTION

A. The Fitness & Day Rooms shall be provided with a complete locally controllable audio system. All equipment shall conform to the manufacturer's latest published specifications in feature and function both physically and electronically whether or not those specifications are delineated herein. The manufacturer's latest published specifications shall be considered as part of this text.

2.2 MIXER / AMPLIFIER:

A. Provide Ashly Audio mXa-1502 or equal. The unit shall consist of a two-channel, multi-mode Class D amplifier capable of driving 2 Ohm loads at full power. Each channel shall have selectable output mode of Low Z, 25V, 70V, or 100V with a maximum rated output power of 150W per channel in all modes and will be bridgeable to deliver a single channel power output of 300W @4 or 8 Ohms. There shall be an automatic but defeatable sleep mode consuming <1W. A switch-mode power supply with active Power Factor Correction (PFC) shall auto-detect 100 – 240VAC mains and operate from 70 – 270VAC.

The unit shall have a multi-channel, user-programmable DSP capable of mixing 8-mic/line inputs, plus 4 stereo line inputs into 4 independent outputs. The mic inputs shall each provide 48V phantom power, switchable per channel via software. Each Input DSP channel shall have up to six assignable DSP function blocks, which shall be arrangeable in any order by the user and which may include: Gain, VCA Gain, DCA Gain, Remote Gain, 10-band PEQ, 31-band graphic EQ, HPF, LPF, Compressor, Auto-Leveler, Brick Wall Limiter, Gate, Feedback Suppressor, Delay, Signal Generator & Meter. DSP functions for the stereo channels shall also be stereo. Each Input shall allow routing to up to four mixers, each of which provides: Gain, Meter, Auto-Mix & Ducker assignable to each input channel. The unit's Output DSP consists of four channels, each having six assignable blocks, also arrangeable in an order by the user and which may include: Gain, VCA Gain, DCA Gain, Remote Gain, 10-band PEQ, 31-band graphic EQ, HPF, LPF, Compressor, Auto-Leveler, Brick Wall Limiter, Gate, Ambient Noise Compensation, FIR Filters, Delay, X-Over (2, 3 & 4-way), Signal Generator & Meter. Each Output Channel shall allow receiving a signal from any one of the four mixers as determined by the user. The four Output Channels shall feed the two amplifier channels (AMP OUT 1 & AMP OUT 2) and the two AUX Line Out Channels (AUX OUT 1 & AUX OUT 2) respectively in a fixed configuration.

The unit's DSP shall also incorporate an RTC (Real-Time Clock), which can be synchronized to an external clock source (such as a PC or NTP server). The unit shall have a built-in scheduler (driven by the RTC), which can be programmed by the user for various timed operations, such as: power-on/standby, preset recall, sub-preset recall, source select, channel mute/unmute & channel gain adjustment (±). The unit's DSP shall be managed by an internal web-server and database and controlled by a networked PC or tablet device which is browser-enabled. It shall therefore not be required that a separate software application be installed on a PC or other device, in order for the user to access DSP functions.

Mechanical: The front panel shall have LEDs indicating Input Signal (green), Clip/Mute (Red), Current (Green) and Temperature (Yellow) for each power channel and will also have global LEDs for indicating

the amp's Protect (Red), COM (Green), Disable (Yellow) and Sleep (Blue) modes. The front panel shall have four momentary buttons that may be user-programmed to perform preset recall or source-select functions. There shall also be a round momentary Power button with a white LED backlight to indicate the amp's "ON" status. The front grille shall be composed of high-impact resin and shall be perforated to allow proper airflow.

The unit's rear panel shall have 8-Balanced Mic/Line inputs each with removeable 3.5mm Euroblock connectors and will also have 4-stereo unbalanced Line Inputs, each with dual RCA phono connectors. The unit will have two balanced line (AUX) outputs with removeable 3.5mm Euroblock connectors and two powered speaker outputs, which shall have 7.62mm Euroblock connectors. The unit shall have 8-adressable GPI & 2-GPO, 2-Amplifier Fault, 3-VC Remote, 1-Serial Data and 1-Amplfier Standby ports, all with removeable 3.5mm Euroblock connectors. There shall be a DIP-switch pair for each power amp allowing selection of amplifier mode (Low Z/25/70/100V). The unit shall be networkable and shall have an RJ45 100/1000BaseT Ethernet jack. The unit shall have a detachable IEC power receptacle capable of working with region appropriate power cables.

The unit shall be housed in a 1U metal chassis, with front and side perforations to allow proper cooling from the variable-speed fan. The unit shall weigh <11.3 lbs. (5.1kg) and shall measure 19" W x 1.75"H x 14.54" D (483mm x 45mm x 369mm) and mount in a standard 19" rack. There shall be a five-year warranty for units purchased in the US.

B. Provide Ashly Audio AquaTouch7, 7" color touch-panel for remote control access to the Ashly mX81502 mixer/amplifier. Provide necessary mounting brackets for a flush apperance.

2.3 MULTI-MEDIA PLAYER

A. Provide Tascam BD-MP1MKII or equal. The media player shall feature:

Supported Media: Blu-ray: BD25, BD50, BD-ROM, BD-R(SL,DL), BD-RE(SL,DL), DVD: DVD-ROM, DVD-R (SL, DL), DVD-RW, DVD+R (SL, DL), DVD+RW, CD: CD-DA, CD-R, CD-RW.

Disc formats: Blu-ray 3D supported, Blu-ray BDMV, BDAV: DVD: DVD-Video, DVD-VR, AVCHD, File formats USB flash drive and SD card formats must use FAT16,FAT32, exFAT or NTFS file systems.

File Formats: Video: ASF, MPG, AVI, 3GP, DAT, MKV, MOV, M2TS, OGM, TP, TS, MP4, WMV, Audio: WAV, MP3, WMA, AAC, FLAC, APE, Picture: JPEG, GIF, PNG, Supported subtitle file format: sub, .ass, idx+sub (.idx+.sub)

Audio: BD/DVD/USB/SD, Sampling frequency: 44.1k/ 48k/ 64k/ 88.2k/ 96k/176.4k/ 192k Hz, Bit length: 16/24 bit

CD Sampling frequency: 44.1k/48k Hz, Bit length: 16/24bit, MP3/WMA Sampling frequency: 32k/44.1k/48k Hz, MP3: 112k to 320k bps, WMA: 48k to 192k bps

HDMI Output: Connector: HDMI 19pin Type A, Resolution: 480i/576i, 480p/576p, 720p, 1080i, 1080p, Aspect ratio: 16:9 Full, 16:9 Normal, 4:3 Pan & Scan, 4:3 Letterbox, Video format: NTSC, PAL, Multi, HDMI signal system: RGB PC level, RGB Video level, YCbCr(4:4:4), YCbCr(4:2:2)

Digital Audio output: COAXIAL, Connector: RCA pin jacks, Format: IEC60958-3(S/PDIF), Output impedance: 75 Ω or lower. Analog audio outputs: Balanced Connectors: XLR-3-32(1 : GND, 2 : HOT, 3 : COLD) × 2 (Stereo), Normal output level: +4dBu (1.23 Vrms), Maximum output level: +20dBu (7.75 Vrms), Output impedance: 200Ω or lower

Unbalanced Connector: RCA pin jack × 1 pair, Normal output level: -10dBV (0.316 Vrms), Maximum output level: +6dBV (2.0 Vrms), Output impedance: 210Ω or lower

7.1ch Audio outputs Connector: RCA x8 (FL/FR/SL/SR/SBL/SBR/C/SW), Connector Color: FL/SL/SBL: White, FR/SR/SBR: Red C/SW: Black, Normal output level: -10dBV (0.316 Vrms), Maximum output level: +6dBV (2.0 Vrms), Output impedance: 210Ω or lower

RS-232C Connector: D-sub 9pin, Format: RS-232C compliant

ETHERNET Connector: RJ-45, Protocol: 10BASE-T/100BASE-TX, Cable: Category 5e or faster

USB Connector: USB type-A ×2 (front ×1, back ×1), Protocol : USB2.0 compliant, Rated supply voltage DC 5V, 1A, Mass storage class Less than 2 TB, File format: FAT16/FAT32/exFAT/NTFS, USB device class:Mass storage class SD slot Supported media: SD (512 MB-2 GB), SDHC (4 GB-32 GB), SDXC (64GB - 512GB), File format: FAT16/FAT32/exFAT/NTFS

Output Section: Analog Out L/R- Type: RCA terminal, Load impedance: Over 10 k/kohms, Output level: 2 Vrms / at 10 k/kohms load.

2.4 WIRELESS BLUETOOTH EXTENDER

A. Provide RDL (Radio Labs) D-BT1A wall mounted Bluetooth audio Format-A interface or equal.

1. The interface shall feature:
    a. Bluetooth Audio Input for Installed Sound System
    b. Intuitive Single Button Pairing with LED Status Indication
    c. Special Software Not Required for Module SetupCustomize the Module ID Name and Programming Password through the Bluetooth Connection
    d. Sends Received Bluetooth Audio to RDL Format-A Receivers
    e. Mono Summed or Stereo Audio Input Mode is Switch-Selectable on Rear Panel
    f. Rear-Panel Switch Selects which RJ45 Pair (A, B or C) is Fed in Mono Summed Mode
    g. Daisy-Chain up to Three D SERIES-BT1A modules to One Format-A Receiver in Mono Mode
    h. Remotely Powered through Twisted Pair Cable
    i. Signal and Power Pair Pass-Through on RJ45 Jacks

Required additional equipment shall include at least one compatible Format-A receiver and its recommended power supply.

Provide RDL (Radio Labs) TX-TPR2A active two-pair receiver, twited pair Format-A or equal. The TX-TPR2A is a two-pair audio receiving module compatible with RDL Format-A twisted pair products. Two outputs are provided corresponding to the two signal pairs B and C. The audio signal received on each pair of the RJ45 INPUT jack feeds the corresponding -10 dBV unbalanced output and the +4 dBu balanced output on the detachable terminal block. A studio-quality amplifier feeds the outputs at the correct operating level.

The TX-TPR2A features bridging inputs, allowing it to be connected to the LOOP OUT jack of other receivers. The bridging input circuits used in all FORMAT-A twisted pair receivers allow connection of up to 10 receiver outputs for each cable pair.The TX-TPR2A may be powered directly from a 24 Vdc power supply. Local power connected to the module is also fed to all modules connected to the INPUT

RJ45 jack. The TX-TPR2A may be remotely powered through the twisted pair cable from any other module, signal distributor or RDL power inserter connected to the same twisted pair cable. Module power is indicated by a front-panel LED.

2.5 LOUDSPEAKERS

A. Provide *Desono P30DTD*, 2-way, 4.25" pendant loudspeaker or equal. The loudspeaker shall feature: Loudspeaker Type: 2-way, 4.25-inch, pendant loudspeaker, Operating Mode: Passive, Operating Range: 76 Hz - 20 kHz, Beamwidth: 120°, conical, Transducers: LF 1 x 4.25 inches (108 mm) coated paper cone, HF 1 x 1 inch (25 mm) soft dome, Transformer: 70V: 30W, 15W, 7.5W, 3.75W, 1.75W, 100V: 30W, 15W, 7.5W, 3.75W, Control: Power tap / low impedance selector switch. Sensitivity: (1W/1m) 87 dB, Dispersion: 120° conical, Drivers: LF 1 x 4.25 inches, HF 1 x 1 inch, Impedance: 16Ω, Maximum Output: 105 dB, 110 dB Peak

Mounting: Two 5m (16.4 ft) wire suspension cables (one as primary support, one as a safety cable), of high tensile galvanized steel wire rope with integrated spring clips for attaching the cable to the bracket and Gripple cable fasteners. Included Accessories: Two wire suspension cables, Two Gripple cable fasteners, End cap and cable cover. Optional Accessories: MC-PHK16-12PK: Pendant Hanging Kit with twelve (12) 5m (16ft) lengths of Magic Cable and the connectors to suspend snap-hook-mounted pendant loudspeakers. Available in White or Black. Suspension system and Gripple cable fasteners listed per UL1598 and UL2239, TUV and CSA Class 3426-01 and Class 3426-81.

Height 8.8 inches (223 mm), Diameter 9.2 inches (233 mm), Weight 5.7 lbs (2.6 kg) Finish: Color by Architect (Black or White), Enclosure: ABS plastic, matte finish, White or Black, Grille: Powder-coated perforated steel. Operating Environment: Indoor, Power: 50W Cont., 200W Peak, Certifications: ETL listed to comply with UL Std 1480A, Certified to CSA C22.2#62368-1

2.6 RACK ENCLOSURE

2.7 RECESSED WALL RACK ENCLOSURE

A. Provide Lowell Sound Rack #LTCR-3320, Recessed, Tilt-out, lockable audio rack or equal.

B. The wall rack with tilt-out operation shall feature: Dimensions - 34.06"H x 6.8"D x 25.00"W. Construction shall be steel with neutral Network Grey powder epoxy finish.

C. The rack shall feature two bays, top/bottom vents, and combination knockouts in top, bottom, and rear. The upper bay with hinged pocket door shall mount 19"W x 5.25"H (3U) x 4.3"D equipment horizontally and include 10-32 threaded rails that pivot down for access. The lower bay shall tilt down to open (dampers shall control the rate of descent). It shall mount 19"W x 5.25"H (3U) x 15.3"D equipment vertically and feature 10-32 threaded rack rails plus a removable shelf. The assembly shall have a load capacity of 50 lbs. and include a single gang E.O. box in the base. Options: The rack shall include a 3U x 19"W punched panel to mount one-gang devices, #D8P-ID-3.

D. The contractor shall install the recessed tilt-out wall rack in accordance with ADA specifications for wheel chair accessibility. The locking and (or) opening mechanism shall not exceed 44" above finished floor when in the closed position.

2.8 MICROPHONES AND CABLES:

A. The following microphones, cables, and stands shall be provided for various assembly purposes (supply for each room):

1. Wired Microphones and Cables:
   a. Provide 2 (two) Shure SM58-CN cardioid, dynamic microphones or equal.
   b. Provide 2 (two) XLR male to XLR female shielded microphone cables, 25 feet in length.
   c. Provide 2 (two) Ultimate MC-77B micrphone stands or equal. Stand shall feature one-handed height adjustment, weighted and stackable bases, telescoping height of 39" to 64". Color shall be black.
   d. Provide 2 (two) 1/8" male to XLR male patch cable, 6' (feet) in length.
   e. Provide 2 (two) 1/4" male to XLR male patch cable, 6' (feet) in length.

2.9 MICROPHONE & LINE LEVEL I/O PLATES

A. Provide stainless steel microphone / line input plates for connection of microphones and line level equipment. Quantity, location, and type of plates are listed on the drawings. The microphone / line input plates shall be terminated and properly marked to the audio rack. All plates shall be engraved as described on the drawings. Silk screen identification will not be accepted. Face plate color shall be stainless steel with black engraved letters.

B. Where XLR jacks are shown on the drawings, provide Neutrik connector NCJ9FI, 3- pole female XLR & 1/4" switching mono-jack or equal. ***Single, non-combo jacks will not be accepted.***

PART 3 EXECUTION

3.1 CONTRACTOR'S DOCUMENTATION

A. As-Built Drawings. Provide three (3) sets. The Contractor shall provide complete point to point wiring schematics of all system components including audio, video and control. Drawings shall include cable numbering, equipment locations, jacks, input /output plates etc.

B. A final set of as-built drawings shall be provided within 10 working days of acceptance by the Owner. Two copies of this as-built information shall be provided one to the Owner and one to the Engineer. As-builts shall be provided on reproducible media, and one SSHDD device (SD- media, thumb drive, etc).

C. The Contractor is to keep on file a complete set of as-built drawings to be used for future service actions and future system enhancements.

D. Any and all custom furniture, carts, consoles etc. shall be documented in CAD form and provided with the as-builts.

E. Any and all wall plates, auxiliary panels etc. are to be provided as a part of the as-builts.

F. Manufacturer Documents - Provide three (3) sets. All equipment item manufacturer manuals shall be provided as a part of the contractors documentation package. All manuals are to be inserted into 3 ring binders. Also included in these binders are to be a complete equipment list of the serial numbers and manufacturer warranty information

G. After project completion, the contractor shall deliver to the Engineer, (1) 1.75 Litre of Malibu Coconut Rum, or equal.

3.2 COOPERATION WITH OTHER TRADES

A. It shall be the responsibility of the Contractor to cooperate at all times, and to the fullest extent, with all trades doing work in the building.

B. The Contractor shall be responsible to meet anticipated project schedules regardless of any and all local disputes.

3.3 INSTALLATION STANDARDS

A. Qualified technicians shall perform all equipment, cabling and materials installation in a professional manner, in accordance with industry standards.

B. All equipment (permanent and portable) will be mechanically mounted as needed to prevent any unwanted movement (instability, vibration) during normal usage.

C. All mounting hardware and/or brackets shall be concealed wherever possible. The same type of hardware shall be used on all wall plates.

D. All equipment will be mounted with symmetry and center of gravity in mind.

E. All cabling on portable equipment will be dressed neatly and orderly with care taken that no cabling can be "snagged" when it is being moved.

F. All audio and control cabling will be installed within the NEC installation parameters for application and routing.

G. All cabling will be installed in a neat and orderly fashion.

H. Cabling:

1. All audio and control cabling will be installed within the NEC installation parameters for application and routing.
2. All cabling will be installed in a neat and orderly fashion.
3. Cabling will be secured and strain-relieved at all appropriate locations.
4. All cable connections to equipment will have maximum accessibility and cable labels will be visible.
5. Any piece of equipment will be removable without cutting wire ties or cable harnesses.
6. Service loops will be provided where necessary.
7. All cables run through plenum environments will be Teflon-jacketed in accordance with local fire codes.
8. Cables will not be gouged, bent, or otherwise damaged during installation or termination. Cables will not rest against any sharp metal edges. Grommets, plastic collars, or rubberized tape will be used where appropriate.
9. Cables and bundles will be dressed to look neat, orderly, and with the idea that a technician, who may be unfamiliar with the system, can find his or her way around the system with the aid of the documentation.

I. Equipment Rack Cabling Practices:

1. Internal equipment rack cabling shall conform to professional installation standards. All cables should be securely mounted within the rack to allow easy removal of the connector and visibility of the cable label. All cables shall be run to approach its connection point at the perpendicular, with a minimum length of 4" between the connector itself and the cable secured mounting. Cabling and connections shall include sufficient stain relief and lack of stress to eliminate potential intermittent break in proper signaling.
2. AC electric power strips shall be mounted on the left side of the equipment rack. All equipment power shall be derived from this central power location and not intermingled with signal or control cabling. High Voltage surge protection will be included where necessary to protect sensitive electronic equipment from harmful voltage spike.
3. Audio cabling shall be grouped in accordance to the signal level present in the specific wiring, paying careful attention to the separation of microphone level, line level and amplified signal levels.

J. Connection Plates:

1. All connection plates will be aluminum or stainless steel stock unless otherwise requested by owner.
2. All connectors will be isolated from AC power.

K. Cable Labeling:

1. All cables will be labeled the same at both ends.
2. Cable label designations will be clearly marked on schematic and block diagrams.
3. Labels shall be located 3 to 9 inches from connector.
4. Labels will be of 3M ScotchCode, Brady TM (or equivalent).

L. Wallplates:

1. Wallplates will be fabricated to match the architectural finishes.
2. Wallplates will be engraved with permanent lettering and numbering.
3. Final layout lettering will be approved by the Owner or their representative prior to fabrication.

M. Clean-up:

1. The Contractor will perform a general clean-up at the close of every work session. This will include clean-up of debris generated by the Contractor's technicians to the appropriate refuse containers on the particular floor on which they are working.
2. The Contractor will, at all times, keep hazards to minimum. Items to be left on site (if any) will be stored in an orderly and "out-of-the-way" manner and are not the responsibility of the Owner. The exception to this would be for items left in Owner approved locked storage areas.

3.4 OWNER TRAINING

A. Training shall be provided to the owner for each installed system. A minimum of two separate training sessions shall be conducted upon owner acceptance of the system.

1. *The first training session shall be a minimum of two hours.*
2. Training shall consist of detailed operating functions and overall explanations of each systems capabilities and functionality.
3. A user's manual shall be used as a guide for training.

4. *A follow up training within 60 days of Owner acceptance shall also be provided. This session to be a minimum of one hour.*
5. Contractor shall be present for the first event during operation.
6. *All training sessions shall be video-taped. The tape shall be turned over to the Owner for future reference on either CD, DVD, or solid state media.*

3.5 WARRANTY

A. All manufacturer warranties are to apply for all equipment provided in this contract. For a minimum, all equipment items shall carry a manufacturer warranty that is supported by the installing contractor for a period of one year from the date of acceptance by the owner.

B. Manufacturer warranties that provide more than one-year coverage shall also apply.

C. If the contractor is not an authorized dealer for equipment provided, it is the sole responsibility of that contractor to bear all costs of providing warranty services for those equipment items. During the first year of system operation the owner shall bear no costs for any warranty repairs, and the contractor shall provide 24-hour service response for the first year. Any contractor modified equipment items that may render the original manufacturer's warranty void shall be warranted 100% by the installing contractor for a period of one year.

3.6 PERFORMANCE TESTING

A. The following details the minimum acceptable systems performance test procedures and results for audio and video systems performance.

1. Test Equipment Required:
   a. Variable Sine Wave Generator
   b. Sound Pressure Level Meter
   c. Distortion Analyzer
   d. Calibrated Microphone
   e. Real Time Spectrum Analyzer
   f. AC/DC Voltage/Ohm Meter
   g. Impedance Meter
2. Performance Standards: Unless restricted by the published specifications of a particular piece of equipment, or unless otherwise mandated by the system applications, the following shall be the minimum performance specifications of the system.
   a. Signal/ Noise Ratio, 55 dB minimum, (including crosstalk and hum)
   b. Total Harmonic Distortion, 1% maximum from 40 Hz to 15,000 Hz.
   c. Frequency Response, 40 Hz to 15,000 Hz +/- 2 dB, (Program Playback)
3. Application of Performance Specification: The minimum performance specifications cited above shall apply equally to individual equipment components and to all inter-component connections, including but not limited to: distribution amplifiers, switchers, signal routers, patch bays. All point to point interconnections between sources and outputs shall meet the aforementioned system specifications.

END OF SECTION 27.4100

SECTION 27.4200 - COMMUNITY ROOM AV SYSTEM

PART 1 GENERAL

1.1 WORK INCLUDED

A. The Community Training Room shall be provided with a complete locally controllable AV system. All equipment shall conform to the manufacturer's latest published specifications in feature and function both physically and electronically whether or not those specifications are delineated herein.

1.2 SUBMITTALS

A. Submit the following in accordance with Conditions of Contracts and Division 1 specifications sections:

B. Audio functional drawings for each system

C. Rack elevations

D. Loudspeaker mounting details

E. Conduit riser

F. AV plate details

G. Cable pull schedule

H. Manufacturer equipment specification sheets

1.3 QUALIFICATIONS OF BIDDERS

A. The bidder shall be a firm with a minimum of 5 years of experience in the fabrication, assembly, and installation of audio systems of similar magnitude and quality as specified in these documents, and shall submit documentation to this effect with the bid return.

B. The bidder shall be I.C.I.A / A.V.S.P certified.

1.4 ALTERNATE EQUIPMENT

A. This equipment was selected to establish a standard of quality and performance. The contractor may offer substitutes for approval but the burden of proof of equality shall be with the contractor.

B. Pre-approval submittals shall contain a component-by-component comparison of all specification lines. Differences shall be clearly high-lited with withe explanation and support data. Connection drawings shall also be provided to establish how the substituted components will achieve the specified system design

C. The contractor shall provide any additional documentation, samples, or performance tests required by the Engineer in order to establish proof of equality with the specified equipment.

D. All substitutions shall provide equal of greater system performance and function. No substitute equipment shall be purchased or installed without approval by the Engineer.

E. Final approval of the substituted equipment shall be given after the system has been installed. Failure to meet the specification, as determined by the Engineer, shall result in the removal of the substituted equipment and the installation of the specified equipment without any additional cost to the owner.

F. When a piece of specified equipment has been discontinued by the manufacturer or is unavailable due to lack of inventory, the contractor may substitute the *manufacturers recommended* replacement without notice to the Engineer. If a piece of equipment is not replaced by a newer model with the same or better features and a different manufacturer can supply a piece of equipment that meets or exceeds the original specified equipment, the contractor shall notify the Engineer and submit the equipment cut sheets for approval.

1.5 EXCEPTIONS

A. Any and all exceptions to these specifications and related drawings must be made with the submission of the bid. In the absence of exceptions, the specifications and related drawings shall be binding in letter and intent on the successful bidder. It will also be understood that the bidder has examined the design and specifications in detail, and is prepared to take full responsibility for the performance of the complete installation as designed and specified.

1.6 SUB-CONTRACT INFORMATION

A. Any and all sub-contractors that a bidder plans to utilize for this project are to be listed with the references and qualifications in the bid submission. The successful bidder shall supervise all sub-contract work. Any and all sub-contract work is the complete and sole responsibility of the contractor.

1.7 SPECIFICATION INFORMATION REQUESTS AND QUESTIONS

A. Any requests for clarification shall be submitted to Mr. DJ Seibert of Snyder Hoffman Associates, 1005 West Lehigh Street, Bethlehem, PA, 18018, 610-694-8020, dseibert@snyderhoffman.com. All requests are to be made in writing and submitted no later than ten days prior to bid submission.

1.8 CERTIFICATIONS AND REPRESENTATIONS

A. Quality of materials: All equipment items and installation materials will be new. No previously owned, demonstrated or otherwise used items will be provided. Note that prior to equipment installation and on-site integration, all equipment items shall be performance tested and quality checked to insure full functionality of each equipment item.

B. Tax Statement Certification: The contractor certifies that all local, state, and federal taxes are separately listed in any price quotations.

1.9 QUALITY ASSURANCE

A. All equipment and materials provided for this contract are to be new and shall meet or exceed the latest published specification of the manufacturer for that item.

B. All equipment shall be UL listed or equivalent.

1.10 NOT IN CONTRACT

A. Some equipment related to the audio system will be provided under the Electrical Contract. Unless otherwise indicated in these specifications or related drawings, these will include the following:

1. All electrical breaker / load panels.
2. Receptacles / switches.

1.11 ACCEPTABLE MANUFACTURERS

A. The AV equipment as part of this design shall be manufactured by:

1. Extron Electronics, USA - East
   2500 N. Raleigh Boulevard
   Raleigh, North Carolina 27604
   Phone: 1-800-633-9876
   Web: www.extron.com

B. Alternative Manufacturers: Subject to compliance with requirements, manufactures offering products that may be incorporated into the work include, but not limited to, the following:

1. Crestron Electronics Inc
   15 Volvo Drive
   Rockleigh, NJ 07647
   Phone: 201-767-3400
   Web: www.crestron.com

PART 2 PRODUCTS

2.1 EQUIPMENT DESCRIPTION

A. Provide the following equipment or equal. Equipment model, part numbers and quantities are listed on the Bid Documents. The manufacturer's latest published specifications shall be considered as part of this text for each piece of equipment listed and shown on the drawings.

2.2 AUDIO VISUAL COMPONENTS

A. Matrix Switchers:

1. Extron DTP3 CrossPoint 622, 4K/60 Presentation Matrix Switcher Configurable from 6x4 to 8x2, Part #60-1570-13.

B. Control Devices:

1. Extron TLP Pro 1035M, 10.1" Wall Mount TouchLink Pro Touchpanel, Part #60-1998-03

C. I/O Devices:

1. Extron WPD 100 AV, Audio, Video, and Data Pass-Through Wallplate, Part #70-726-63
2. Extron AXI 22 AT D Plus, 2 Input, 2 Output Dante Audio Interface - Decorator-Style Wallplate, Part #60-1947-01
3. Extron DTP3 T 212 D Two Input 4K/60 DTP3 Transmitter for USB-C and HDMI, Part #60-1714-53
4. Extron DTP HDMI 4K 230 Tx DTP Transmitter for HDMI, Part #60-1271-12
5. Extron DTP R HWP 4K 231 D, DTP Receiver for HDMI - Decorator-Style Wallplate, Part #60-1531-13

D. Access Points:

1. Extron WAP 100AC, Wireless Access Point, Part# 60-1635-01

E. Speakers:

1. Extron SF 26CT Speakers, Part #60-1310-03

F. Where data cables are marked as CATx on the drawings, the contractor shall provide the cable types as recommended by the manufacturer of the equipment that will be installed.

G. Where the Extron TLP touchpanels are shown on the drawings, the contractor shall consult with the owner on the look and functionality of the displays. The contractor shall provide the owner with mock up copies for the owners approval prior to programming the displays.

2.3 MULTI-MEDIA PLAYER

A. Provide Tascam BD-MP1MKII or equal/ The media player shall featurte:

Supported Media: Blu-ray: BD25, BD50, BD-ROM, BD-R(SL,DL), BD-RE(SL,DL), DVD: DVD-ROM, DVD-R (SL, DL), DVD-RW, DVD+R (SL, DL), DVD+RW, CD: CD-DA, CD-R, CD-RW.

Disc formats: Blu-ray 3D supported, Blu-ray BDMV, BDAV: DVD: DVD-Video, DVD-VR, AVCHD, File formats USB flash drive and SD card formats must use FAT16,FAT32, exFAT or NTFS file systems.

File Formats: Video: ASF, MPG, AVI, 3GP, DAT, MKV, MOV, M2TS, OGM, TP, TS, MP4, WMV, Audio: WAV, MP3, WMA, AAC, FLAC, APE, Picture: JPEG, GIF, PNG, Supported subtitle file format: sub, .ass, idx+sub (.idx+.sub)

Audio: BD/DVD/USB/SD, Sampling frequency: 44.1k/ 48k/ 64k/ 88.2k/ 96k/176.4k/ 192k Hz, Bit length: 16/24 bit

CD Sampling frequency: 44.1k/48k Hz, Bit length: 16/24bit, MP3/WMA Sampling frequency: 32k/44.1k/48k Hz, MP3: 112k to 320k bps, WMA: 48k to 192k bps

HDMI Output: Connector: HDMI 19pin Type A, Resolution: 480i/576i, 480p/576p, 720p, 1080i, 1080p, Aspect ratio: 16:9 Full, 16:9 Normal, 4:3 Pan & Scan, 4:3 Letterbox, Video format: NTSC, PAL, Multi, HDMI signal system: RGB PC level, RGB Video level, YCbCr(4:4:4), YCbCr(4:2:2)

Digital Audio output: COAXIAL, Connector: RCA pin jacks, Format: IEC60958-3(S/PDIF), Output impedance: 75 Ω or lower. Analog audio outputs: Balanced Connectors: XLR-3-32(1 : GND, 2 : HOT, 3 : COLD) × 2 (Stereo), Normal output level: +4dBu (1.23 Vrms), Maximum output level: +20dBu (7.75 Vrms), Output impedance: 200Ω or lower

Unbalanced Connector: RCA pin jack × 1 pair, Normal output level: -10dBV (0.316 Vrms), Maximum output level: +6dBV (2.0 Vrms), Output impedance: 210Ω or lower

7.1ch Audio outputs Connector: RCA x8 (FL/FR/SL/SR/SBL/SBR/C/SW), Connector Color: FL/SL/SBL: White, FR/SR/SBR: Red C/SW: Black, Normal output level: -10dBV (0.316 Vrms), Maximum output level: +6dBV (2.0 Vrms), Output impedance: 210Ω or lower

RS-232C Connector: D-sub 9pin, Format: RS-232C compliant

ETHERNET Connector: RJ-45, Protocol: 10BASE-T/100BASE-TX, Cable: Category 5e or faster

USB Connector: USB type-A ×2 (front ×1, back ×1), Protocol : USB2.0 compliant, Rated supply voltage DC 5V, 1A, Mass storage class Less than 2 TB, File format: FAT16/FAT32/exFAT/NTFS, USB device class:Mass storage class SD slot Supported media: SD

(512 MB-2 GB), SDHC (4 GB-32 GB), SDXC (64GB - 512GB), File format: FAT16/FAT32/exFAT/NTFS

2.4 WIRELESS BLUETOOTH EXTENDER

A. Provide RDL (Radio Labs) D-BT1A wall mounted Bluetooth audio Format-A interface or equal. https://rdlnet.com/product/d-bt1a/

1. The interface shall feature:
   a. Bluetooth Audio Input for Installed Sound System
   b. Intuitive Single Button Pairing with LED Status Indication
   c. Special Software Not Required for Module SetupCustomize the Module ID Name and Programming Password through the
   d. Bluetooth Connection
   e. Sends Received Bluetooth Audio to RDL Format-A Receivers
   f. Mono Summed or Stereo Audio Input Mode is Switch-Selectable on Rear Panel
   g. Rear-Panel Switch Selects which RJ45 Pair (A, B or C) is Fed in Mono Summed Mode
   h. Daisy-Chain up to Three D SERIES-BT1A modules to One Format-A Receiver in Mono Mode
   i. Remotely Powered through Twisted Pair Cable
   j. Signal and Power Pair Pass-Through on RJ45 Jacks

Required additional equipment shall include at least one compatible Format-A receiver and its recommended power supply.

Provide RDL (Radio Labs) TX-TPR2A active two-pair receiver, twited pair Format-A or equal. The TX-TPR2A is a two-pair audio receiving module compatible with RDL Format-A twisted pair products. Two outputs are provided corresponding to the two signal pairs B and C. The audio signal received on each pair of the RJ45 INPUT jack feeds the corresponding -10 dBV unbalanced output and the +4 dBu balanced output on the detachable terminal block. A studio-quality amplifier feeds the outputs at the correct operating level.

The TX-TPR2A features bridging inputs, allowing it to be connected to the LOOP OUT jack of other receivers. The bridging input circuits used in all FORMAT-A twisted pair receivers allow connection of up to 10 receiver outputs for each cable pair. The possibility of multiple receiver locations adds enormous flexibility in the design of audio routing systems using RDL FORMAT-A products. The TX-TPR2A may be powered directly from a 24 Vdc power supply. Local power connected to the module is also fed to all modules connected to the INPUT RJ45 jack. The TX-TPR2A may be remotely powered through the twisted pair cable from any other module, signal distributor or RDL power inserter connected to the same twisted pair cable. Module power is indicated by a front-panel LED.

2.5 AV MANAGED SWITCHES

A. Provide PoE++ managed switches. Switches manufactured by Netgear, Cisco, Trendnet, and similar manufacturers will be accepted. Provide the number of ports required for the system designed (regardless of the port quantity noted on the dwgs) with a minimum of (4) additional open ports for future use.

B. When required for specific AV equipment, provide PoE IEEE 802.3af network routers.

2.6 MICROPHONES (WIRED & WIRELESS)

A. The following microphones, cables, and stands shall be provided for various assembly purposes:

1. Wired Microphones and Cables:
   a. Provide 2 (two) Shure SM58-CN cardioid, dynamic microphones or equal.
   b. Provide 2 (two) XLR male to XLR female shielded microphone cables, 25 feet in length.
   c. Provide 2 (two) Ultimate MC-77B micrphone stands or equal. Stand shall feature one-handed height adjustment, weighted and stackable bases, telescoping height of 39" to 64". Color shall be black.

B. Wireless Microphones

1. Provide Shure QLX-D 124/85Wireless Handheld and Lavalier Combo Wireless Microphone System or equal. The wireless microphone system shall feature the following:
   a. RF Carrier Frequency Range: 470–937.5 MHz, varies by region (See Frequency Range and Output Power table), Working Range: 100 m (328 ft), RF Tuning Step Size: 25 kHz, varies by region, Image Rejection: >70 dB, typical, RF Sensitivity: -97 dBm at 10-5 BER, Latency: <2.9 ms, Audio Dynamic Range: System Gain @ +10 >120 dB, A-weighted, typical, Total Harmonic Distortion: 12 dBFS input, System Gain @ +10 <0.1%, System Audio Polarity: Positive pressure on microphone diaphragm produces positive voltage on pin 2 (with respect to pin 3 of XLR output) and the tip of the 6.35 mm (1/4-inch) output. Operating Temperature Range: 18°C (0°F) to 50°C (122°F), Storage Temperature Range: 29°C (-20°F) to 74°C (165°F)
   b. Power Requirements: 12 V DC @ 0.4 A, supplied by external power supply (tip positive), RF Input: Spurious Rejection >80 dB, typical, Connector Type: BNC, Impedance: 50 O, Audio Output: Gain Adjustment Range: -18 to +42 dB in 1 dB steps.
   c. Configuration: 1/4" (6.35 mm) Impedance balanced (Tip=audio, Ring=no audio, Sleeve=ground) XLR: balanced (1=ground, 2=audio +, 3=audio -), Impedance: 1/4" (6.35 mm) 100 O (50 O Unbalanced), XLR: 100 O, Full Scale Output 1/4" (6.35 mm) +12 dBV, XLR: LINE setting= +18 dBV, MIC setting= -12 dBV, Mic/Line Switch: 30 dB pad
   d. Phantom Power Protection: 1/4" (6.35 mm) Yes, XLR : Yes, Networking: Network Interface: Single Port Ethernet 10/100 Mbps, Network Addressing Capability: DHCP or Manual IP address, Maximum Cable Length: 100 m (328 ft)
   e. QLXD1: Mic Offset Range: 0 to 21 dB (in 3 dB steps), Battery Type: Shure SB900B Rechargeable Li-Ion or AA batteries 1.5 V, Dimensions: 86 mm x 65 mm x 23 mm (3.38in. x 2.57 in. x 0.92 in.) H x W x D, without antenna, Weight: 138 g (4.9 oz.), without batteries. Audio Input: Connector: 4-Pin male mini connector (TA4M), See drawing for details, Configuration: Unbalanced, Impedance: 1 MO, See drawing for details, Maximum Input Level: 1 kHz at 1% THD 8.5 dBV (7.5 Vpp), Preamplifier Equivalent Input Noise

(EIN): System Gain Setting = +20 -120 dBV, A-weighted, typical, RF Output, Antenna Type: 1/4 wave, Impedance: 50 O, Occupied Bandwidth: <200 kHz

f. QLXD2: Mic Offset Range: 0 to 21 dB (in 3 dB steps), Battery Type: Shure SB900B Rechargeable Li-Ion or AA batteries 1.5 V, Dimensions: 269 mm x 51 mm (10.6 in. x 2.0 in.) L x Dia., Weight: 307 g (12.1 oz.), without batteries, Audio Input Configuration, Unbalanced: Maximum Input Level 1 kHz at 1% THD 145 dB SPL (SM58), typical, RF Output Antenna Type: Integrated Single Band Helical, Occupied Bandwidth: <200 kHz, Modulation Type Shure proprietary digital, Power: 1 mW or 10 mW

g. Provide Antenna Distribution System compatible with the wireless microphone system that will be provided. Provide the required quantities as recommended by the manufacturer for the quantity of wireless units that will be provided for this design.

2.7 ASSISTED LISTENING SYSTEM

A. Provide Williams Sound FM+ system package #FM 558-12 or equal. The system shall consist of an FM transmitter, (12) R38 receivers, (12) Surround earphones, (3) neckloops (1) ADA wall plate. The transmitter shall feature: User Interface: 3.12" High Resolution OLED display with selections via buttons. Hosted Web page. Remote control and monitoring. Ethernet: RJ-45 on back of unit supports CAT 5e cable lengths up to 328 feet (100 meters); 10/100 Base-T IEEE 802.3 compliant, unique MAC address, RF Section: Operating Frequencies 72.1-75.9 MHz , 17 wideband channels (selectable), Frequency Accuracy ± 2 ppm stability, 0-50˚ C, Deviation ± 75 kHz maximum, Pre-Emphasis 75 microsec, RF Field Strength Does not exceed 80 mV/m at 3 m, Compatible Antennas ANT 005, ANT 021, ANT 024, ANT 025, ANT 029.

Transmission Range Up to 1000 ft (304 m) with ANT 005 coaxial antenna mounted on rear chassis connector. RF Outputs (1x) #10-32 stud connector in center of unit (pcb mounted) (1x) F-connector on rear chassis, RF Transmit Indicator 1 Green LED On Air Indicator RF Power Full, Medium, Low or OFF indicated by menu icon. RF Time Out (sleep mode) 30 min. duration, 4 hr. duration, or Always On selected via menu. Starts when audio is below -18 dB level with no button pressed for selected duration.

Audio Section: Audio Processor Functions DSP based; Compression: 1:1, 1.5:1 or 2:1; High-pass and Low-pass Filter Frequency control, Frequency Response 31-16000 Hz, ±3 dB (re: 1 kHz, ±3 dB) ("Music" Audio Preset) Signal-to-Noise Ratio 67 dB (typical) Transmitted RF Total Harmonic Distortion Less than 0.25% @ 1 kHz (RF output) Common Mode Rejection Greater than 57 dB @ 1 kHz, Mic or Line.

Audio Inputs (1x) Combination 3-pin XLR, 1/4" (TRS) jack for balanced or unbalanced line level, or balanced or unbalanced microphone with selectable phantom power Audio Input Gain Adjust In menu, adjustable to 0 to -50 dB, in 1dB steps.

Phantom Power 14.4 VDC applied through 2.2 kOhms resistors to analog combo jack: Pin 2 and Pin 3 on XLR jack, or tip and ring on 1/4" TRS jack.

Audio Level Indicators: 10-LED array that reads -18 to +9 dB at 3 dB intervals. 7 Green, 2 Amber, and 1 red LED. Green LEDs indicate normal operating audio level peaks, Amber LEDS indicate close to overload peaks, Red LED indicates overload peaks.

Headphone Output: 1/4" TRS stereo jack, mono signal, 14.85 mW at +9dB, maximum in 33 O (level adjustable in menu 0 to -40 dB in 2 dB steps). Line Output RCA jack (black), -10 dBV (.32 VRMS); Output impedance 100 ohms at +9dB.

Input Levels (Bal or Unbal) (at Audio Input Gain = 0dB) Nominal (1st Amber + 3dB LED) Overload Warning (Displayed on Screen) Absolute Max. Rating.

Microphone -55 dBV (1.7 mV RMS) -22 dBV (80 mV RMS) +20 dBV (10.0 V RMS), Line -25 dBV (55 mV RMS) +16 dBV (6.3 V RMS) +20 dBV (10.0 V RMS) 70° C)

Warranty: 2-year parts and labor. Dimensions 8.45" W x 8.25" D x 1.72"H (21.5 cm x 21 cm x 4.4 cm)

2.8 RACK ENCLOSURE

A. Wall mounted and/or free standing floor audio racks manufactured by Chief, Atlas, Middle Atlantic or equal will be accepted. Included shall be a lockable rear door and a lockable perforated front door. Provide rack with enough space to accommodate all equipment that will be installed in the rack for the system specified. Audio rack shall accommodate equipment to a standard rack width of nineteen inches. Quantities listed on the drawings.

B. Provide all necessary mounting hardware for equipment and wiring.

C. Audio rack quantities & sizes shall be determined by the rack mounted equipment that will be installed. Contractor shall arrange the equipment for proper air flow and accessibility to the equipment mounted in the rack. Provide necessary vented blank panels between equipment. Contractor shall submit a rack elevation with all the equipment, spaces and vents required for approval as part of the shop drawing submittals

D. Equipment locations shown on the drawing rack elevations are for reference only and do not imply final mounted locations of the equipment. Contractor shall locate and install the equipment where it makes sense for the end user's accessibility, especially for wall mounted audio racks. Contractor shall also locate the equipment in the rack to allow for proper air flow-thru of the audio rack and the equipment mounted in the rack.

2.9 RACK POWER

A. Provide Juice Goose JG8.0L power distribution center or equal. Quantities are shown on the drawings.

B. Provide remote power ON/OFF/Sequencing:

1. Juice Goose RC-DM3 power control combiner.
2. Juice Goose RC5-WM power sequence control.
3. Juice Goose CQ-PD1-4 four step power sequencer.

C. Provide SurgeX Sx1120RT power conditioner featuring:

1. Magnetic shielding steel enclosure
2. 8 grounded AC receptacles on rear panel, 6 switched, 2 always on.
3. Front panel courtesy receptacle.
4. Advanced Series Mode surge protection.
5. Advanced Impedance Tolerant EMI/RFI filtering.
6. SurgeX ICE inrush current elimination technology.

7. COUVES catastrophic over/under voltage shutdown.
8. Remote turn on.
9. Thermal circuit breaker overload protection.
10. 10 year warranty.

D. Surgex UPS-1000-Li-2 surge protection or equal for each freestanding or wall mounted rack (not recessed wall racks). The UPS-1000-OL shall be a two-rack-space or tower on-line UPS unit in a steel and plastic enclosure. It shall operate at 120 volts AC at both 50 or 60Hz and have a 6-foot, grounded, 3-wire #14 line cord. There shall be 6 grounded AC receptacles on the back panel.

Technical specifications: Load rating: 83A, Voltage rating: 120V, Input Mains plug type: 5-15P, Receptacle type: 5-15R, Under voltage auto shutdown: yes, Over-voltage shutdown: yes, Over current auto shutdown: circuit breaker, Over temperature auto shutdown: internal temperature fault shutdown, Serial port: RS-232 on female 9-din D-subminiature, USB type B, RJ45 on optional SNMP card.

This unit can accommodate additional battery cabinets to extend its autonomous run time. Overall dimensions shall be 3.39" H x 17.24" W (or 19.0" W with ears) x 16.26"D. Weight shall be 37 pounds. The PS-1000-OL shall have a total load rating of 1,000VA / 900 Watts. This unit can accommodate an optional SNMP network card for unit monitoring and shutdown.

2.10 MICROPHONE & LINE LEVEL I/O PLATES

A. Provide stainless steel microphone / line input plates for connection of microphones and line level equipment. Quantity, location, and type of plates are listed on the drawings. The microphone / line input plates shall be terminated and properly marked to the audio rack. All plates shall be engraved as described on the drawings. Silk screen identification will not be accepted. Face plate color shall be stainless steel with black engraved letters.

B. Where XLR jacks are shown on the drawings, provide Neutrik connector NCJ9FI, 3- pole female XLR & 1/4" switching mono-jack or equal. ***Single, non-combo jacks will not be accepted.***

PART 3 EXECUTION

3.1 CONTRACTOR'S DOCUMENTATION

A. As-Built Drawings. Provide three (3) sets. The Contractor shall provide complete point to point wiring schematics of all system components including audio, video and control. Drawings shall include cable numbering, equipment locations, jacks, input /output plates etc.

B. A final set of as-built drawings shall be provided within 10 working days of acceptance by the Owner. Two copies of this as-built information shall be provided one to the Owner and one to the Engineer. As-builts shall be provided on reproducible media, and one SSHDD device (SD- media, thumb drive, etc).

C. The Contractor is to keep on file a complete set of as-built drawings to be used for future service actions and future system enhancements.

D. Any and all custom furniture, carts, consoles etc. shall be documented in CAD form and provided with the as-builts.

E. Any and all wall plates, auxiliary panels etc. are to be provided as a part of the as-builts.

F. Manufacturer Documents - Provide three (3) sets. All equipment item manufacturer manuals shall be provided as a part of the contractors documentation package. All manuals are to be inserted into 3 ring binders. Also included in these binders are to be a complete equipment list of the serial numbers and manufacturer warranty information

G. After project completion, the contractor shall delliver to the Engineer, (1) 1.75 Litre of Malibu Coconut Rum, or equal.

3.2 COOPERATION WITH OTHER TRADES

A. It shall be the responsibility of the Contractor to cooperate at all times, and to the fullest extent, with all trades doing work in the building.

B. The Contractor shall be responsible to meet anticipated project schedules regardless of any and all local disputes.

3.3 INSTALLATION STANDARDS

A. Qualified technicians shall perform all equipment, cabling and materials installation in a professional manner, in accordance with industry standards.

B. All equipment (permanent and portable) will be mechanically mounted as needed to prevent any unwanted movement (instability, vibration) during normal usage.

C. All mounting hardware and/or brackets shall be concealed wherever possible. The same type of hardware shall be used on all wall plates.

D. All equipment will be mounted with symmetry and center of gravity in mind.

E. All cabling on portable equipment will be dressed neatly and orderly with care taken that no cabling can be "snagged" when it is being moved.

F. All audio and control cabling will be installed within the NEC installation parameters for application and routing.

G. All cabling will be installed in a neat and orderly fashion.

H. Cabling:

1. All audio and control cabling will be installed within the NEC installation parameters for application and routing.
2. All cabling will be installed in a neat and orderly fashion.
3. Cabling will be secured and strain-relieved at all appropriate locations.
4. All cable connections to equipment will have maximum accessibility and cable labels will be visible.
5. Any piece of equipment will be removable without cutting wire ties or cable harnesses.
6. Service loops will be provided where necessary.
7. All cables run through plenum environments will be Teflon-jacketed in accordance with local fire codes.
8. Cables will not be gouged, bent, or otherwise damaged during installation or termination. Cables will not rest against any sharp metal edges. Grommets, plastic collars, or rubberized tape will be used where appropriate.

9. Cables and bundles will be dressed to look neat, orderly, and with the idea that a technician, who may be unfamiliar with the system, can find his or her way around the system with the aid of the documentation.

I. Equipment Rack Cabling Practices:

1. Internal equipment rack cabling shall conform to professional installation standards. All cables should be securely mounted within the rack to allow easy removal of the connector and visibility of the cable label. All cables shall be run to approach its connection point at the perpendicular, with a minimum length of 4" between the connector itself and the cable secured mounting. Cabling and connections shall include sufficient stain relief and lack of stress to eliminate potential intermittent break in proper signaling.
2. AC electric power strips shall be mounted on the left side of the equipment rack. All equipment power shall be derived from this central power location and not intermingled with signal or control cabling. High Voltage surge protection will be included where necessary to protect sensitive electronic equipment from harmful voltage spike.
3. Audio cabling shall be grouped in accordance to the signal level present in the specific wiring, paying careful attention to the separation of microphone level, line level and amplified signal levels.

J. Connection Plates:

1. All connection plates will be aluminum or stainless steel stock unless otherwise requested by owner.
2. All connectors will be isolated from AC power.

K. Cable Labeling:

1. All cables will be labeled the same at both ends.
2. Cable label designations will be clearly marked on schematic and block diagrams.
3. Labels shall be located 3 to 9 inches from connector.
4. Labels will be of 3M ScotchCode, Brady TM (or equivalent).

L. Wallplates:

1. Wallplates will be fabricated to match the architectural finishes.
2. Wallplates will be engraved with permanent lettering and numbering.
3. Final layout lettering will be approved by the Owner or their representative prior to fabrication.

M. Clean-up:

1. The Contractor will perform a general clean-up at the close of every work session. This will include clean-up of debris generated by the Contractor's technicians to the appropriate refuse containers on the particular floor on which they are working.
2. The Contractor will, at all times, keep hazards to minimum. Items to be left on site (if any) will be stored in an orderly and "out-of-the-way" manner and are not the responsibility of the Owner. The exception to this would be for items left in Owner approved locked storage areas.

3.4 OWNER TRAINING

A. Training shall be provided to the owner for each installed system. A minimum of two separate training sessions shall be conducted upon owner acceptance of the system.

1. *The first training session shall be a minimum of two hours.*
2. Training shall consist of detailed operating functions and overall explanations of each systems capabilities and functionality.
3. A user's manual shall be used as a guide for training.
4. *A follow up training within 60 days of Owner acceptance shall also be provided. This session to be a minimum of one hour.*
5. Contractor shall be present for the first event during operation.
6. *All training sessions shall be video-taped. The tape shall be turned over to the Owner for future reference on either CD, DVD, or solid state media.*

3.5 WARRANTY

A. All manufacturer warranties are to apply for all equipment provided in this contract. For a minimum, all equipment items shall carry a manufacturer warranty that is supported by the installing contractor for a period of one year from the date of acceptance by the owner.

B. Manufacturer warranties that provide more than one-year coverage shall also apply.

C. If the contractor is not an authorized dealer for equipment provided, it is the sole responsibility of that contractor to bear all costs of providing warranty services for those equipment items. During the first year of system operation the owner shall bear no costs for any warranty repairs, and the contractor shall provide 24-hour service response for the first year. Any contractor modified equipment items that may render the original manufacturer's warranty void shall be warranted 100% by the installing contractor for a period of one year.

3.6 PERFORMANCE TESTING

A. The following details the minimum acceptable systems performance test procedures and results for audio and video systems performance.

1. Test Equipment Required:
   a. Variable Sine Wave Generator
   b. Sound Pressure Level Meter
   c. Distortion Analyzer
   d. Calibrated Microphone
   e. Real Time Spectrum Analyzer
   f. AC/DC Voltage/Ohm Meter
   g. Impedance Meter
   h. TEF Analyzer
2. Performance Standards: Unless restricted by the published specifications of a particular piece of equipment, or unless otherwise mandated by the system applications, the following shall be the minimum performance specifications of the system.
   a. Signal/ Noise Ratio, 55 dB minimum, (including crosstalk and hum)
   b. Total Harmonic Distortion, 1% maximum from 40 Hz to 15,000 Hz.

c. Frequency Response, 40 Hz to 15,000 Hz +/- 2 dB, (Program Playback)

3. Application of Performance Specification: The minimum performance specifications cited above shall apply equally to individual equipment components and to all inter-component connections, including but not limited to: distribution amplifiers, switchers, signal routers, patch bays. All point to point interconnections between sources and outputs shall meet the aforementioned system specifications.

END OF SECTION 27.4200

SECTION 27.4202 - AV SYSTEM CATX AND XTP CABLING

PART 1 GENERAL

1.1 SUMMARY

A. This section specifies requirements for furnishing, installing, terminating, and testing twisted pair cabling (CATx and XTP) for audiovisual systems.

1.2 REFERENCES

A. ANSI/TIA-568 – Telecommunications Cabling Standards

B. ANSI/TIA-606 – Administration Standard for Telecommunications Infrastructure

C. ANSI/TIA-942 – Telecommunications Infrastructure Standard for Data Centers

D. NEC (National Electrical Code)

E. Manufacturer's installation guidelines

1.3 SUBMITTALS

A. Product data sheets for all cable types and connectors.

B. Manufacturer's written recommendations for cable type required by equipment.

C. Test reports certifying installed cable performance.

D. As-built drawings showing cable routing and labeling.

1.4 QUALITY ASSURANCE

A. Installer shall be a certified low-voltage contractor with demonstrated experience in structured cabling.

B. All cabling shall be installed in accordance with manufacturer's requirements and industry standards.

C. Substitutions are prohibited unless approved in writing by both the Owner's Representative and the equipment manufacturer.

D. Purpose of Requirement: The clause requiring contractors to install the exact type of twisted pair cable recommended by the equipment manufacturer is intended to ensure system compatibility, performance, and warranty compliance. Many AV and communications systems are sensitive to cable type, shielding, and construction. Using the wrong cable can result in degraded performance, interference, or voided warranties.

PART 2 PRODUCTS

2.1 CABLE TYPES

A. CATx Cabling: Cat5e, Cat6, Cat6a, Cat7, or as indicated on drawings.

B. XTP Cabling: Shielded or extra twisted pair cabling where specified.

2.2 CONNECTORS AND ACCESSORIES

A. Manufacturer-approved connectors, patch panels, and termination hardware.

B. Compliance with ANSI/TIA/EIA standards for structured cabling.

C. Shielded connectors for XTP cabling to maintain shielding integrity.

PART 3 EXECUTION

3.1 INSTALLATION

A. Route cabling in conduit, trays, or raceways as indicated.

B. Maintain bend radius and pulling tension per manufacturer's guidelines.

C. Separate cabling from power conductors per NEC and manufacturer requirements.

D. Terminate cables using manufacturer-approved methods.

E. Ensure shielding continuity for XTP cabling.

F. Label all cables at both ends with permanent, machine-printed identifiers.

3.2 TESTING

A. Test all installed cabling per ANSI/TIA/EIA standards for the category specified.

B. Provide certification reports for each cable run.

C. Correct and retest any failed runs at no additional cost to the Owner.

3.3 DOCUMENTATION

A. Submit as-built drawings showing cable routing, terminations, and labeling.

B. Provide manufacturer's cable recommendations and compliance certifications.

C. Include test results in final closeout package.

PART 4 MAINTENANCE AND WARRANTY

4.1 WARRANTY

A. Contractor shall provide a minimum **one-year warranty** on all cabling, connectors, and terminations from the date of substantial completion.

B. Manufacturer's extended warranty programs (if available) shall be registered and transferred to the Owner.

4.2 MAINTENANCE

A. Contractor shall provide maintenance instructions including recommended inspection intervals, cleaning procedures, and troubleshooting guidelines.

B. Contractor shall respond to warranty service calls within **48 hours** of notification.

C. Any repairs or replacements shall be performed using manufacturer-approved materials and methods.

4.3 OWNER TRAINING

A. Provide basic training to Owner's staff on cable identification, labeling system, and proper handling practices.

B. Deliver training materials in both printed and electronic format.

END OF SECTION 27.4202

SECTION 27.5123 – INTERCOMMUNICATION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. The Contractor shall furnish and install all labor, materials, equipment, permits, wiring, and associated components necessary to provide three (3) independent audio systems consisting of a centrally controlled paging system, a dispatch radio system, and a music system, as specified herein and illustrated on the contract drawings.

B. The systems shall include, but not be limited to, control cabinets, loudspeakers, wiring, audio processing and amplification equipment, administrative telephone system interfaces, and all associated equipment and accessories required for complete operation.

C. Each audio system shall provide the necessary functionality to receive, process, amplify, distribute, and reproduce voice and/or music signals, as applicable.

D. The Contractor shall provide all equipment, materials, and installation services necessary to deliver complete and fully operational systems, whether or not each individual component is specifically identified in these specifications or on the drawings.

1.2 SUBMITTALS

A. Submit manufacturer's product literature and installation instructions for all of the major components required for a complete and fully operational system. Submit system wiring diagrams for approval.

B. Submit manufacturer's printed instructions for maintenance of all installed components, including methods for maintaining proper conditions and environment to provide optimum performance. Provide three complete sets of operating instructions including wiring and circuit diagrams.

1.3 QUALIFICATIONS

A. Firms regularly engaged in the manufacture of professional and commercial sound system components with a minimum of five years experience in the design and installation of systems equal in size and type required by this project shall be accepted.

B. The equipment supplier must maintain a local service organization within a fifty (50) mile radius of the installation with spare service replacement components and accessories as needed to ensure a potential down time of no less than eight (8) hours.

C. The supplier must be an authorized representative of the equipment specified with authority to provide warranty rights and rebates. Full-time technicians shall be trained and certified in the installation and service of the equipment. A minimum NICET level 2 certification or in Low Voltage Communication Systems, CTS-I, or CTS-D is required for each full-time technician. Qualified installer must provide twenty-four (24) hours a day seven (7) days a week, as needed for system service and instructional procedures.

1.4 MANUFACTURER

A. The naming of the manufacturer or item is not intended to be restrictive, but rather to establish criteria for system design and quality. Other manufacturers shall be considered for use if submitted for approval ten (10) days prior to the published bid date. The alternate submission shall include all catalog cut sheets and a line-by-line comparison of the specified product, including inter-panel wiring diagrams and schematics. In addition, samples may be required to perform proper evaluation of the proposed alternate at no additional charge. Final approval of the alternate system shall be furnished in an addendum prior to the bid date.

B. The approved manufacturers of the products are as listed below in the product specifications. An authorized distributor of these products is Berkshire Systems Group, Inc. (610) 775-1200.

1.5 DESCRIPTION OF AUDIO SYSTEMS

A. The Audio System shall be capable of reproducing high-quality sound that is free of noise and distortion at all loudspeakers at all times during equipment operation including standby mode with inputs off.

B. The Paging System shall be tied to the central telephone system. Coordinate with the Telephone system Provider to configure the system for dial access paging from any phone on the system. Note that the contractor shall provide in his bid price any additional equipment required for satisfactory operation.

C. Supply and install a complete Public Address System supporting 70-volt speakers and horns. The system shall be capable of three zones of paging and shall be configured to support future expansion.

D. Provide input channels for three (3) radio channels (county radio, etc.) plus an additional auxiliary input on the equipment cabinet.

PART 2 PRODUCTS

2.1 DIGITAL SIGNAL PROCESSOR

A. Provide one (1) Biamp TesiraFORTÉ DAN AI Digital Audio Signal Processor with 12 analog microphone/line inputs and 8 analog outputs, 32 channels of Dante digital audio inputs and 32 channels of Dante digital audio outputs, and up to 8 channels of configurable USB audio. The processor shall have internal DSP processing and shall provide the necessary audio signal routing, mixing, and distribution for the Paging, Dispatch Radio, and Music Systems. The processor shall support Ethernet connections for programming and control through an RJ-45 connector and shall include a dedicated Gigabit Ethernet connection for Dante digital audio networking. The processor shall include a 4-pin General Purpose Input and Output (GPIO) connection for sending or receiving logic signals. The programming of the GPIO functions shall be software configurable. The processor shall include an RS-232 connection for control data transmission into or out of the processor, and such operation shall be software programmable. The processor shall include a USB connection on a standard USB-B type connector. Available system processing components shall include, but not be limited to, mixers, equalizers, filters, crossovers, dynamics/gain controls, routers, delays, remote controls, meters, generators, and diagnostics. The processor shall be programmed to provide independent audio routing, source selection, and level control for each of the three (3) audio systems. The processor shall be installed in the centrally located wall-mounted equipment rack. The processor shall be CE marked, UL listed, and compliant with the RoHS directive. The manufacturer's warranty on the processor shall be five (5) years.

B. Provide three (3) Biamp TEC-1S Ethernet Control Panels. Each control panel shall be a Power-over-Ethernet (PoE) network appliance with an OLED graphical display and capacitive-touch scroll wheel for menu navigation and selection. The control panels shall provide programmable remote control of audio volume, source selection, muting, and preset functions. Each control panel shall communicate with the central DSP via an Ethernet network connection. The control panels shall be programmed to provide independent control of the Paging, Dispatch Radio, and Music Systems, with one (1) control panel assigned to each system. The control panels shall provide user-adjustable audio levels and source selection functions as required for the operation of each respective system. The control panels shall be surface mounted at the locations indicated on the drawings.

C. The Contractor shall provide all required programming and configuration of the Digital Audio Signal Processor and associated control panels. The DSP shall be configured to receive, process, and route audio signals from the Paging, Dispatch Radio, and Music Systems to their respective power amplifiers and loudspeaker circuits. Each system shall operate independently with individual audio level adjustments, source selection, and muting functions through its assigned control panel. The Contractor shall provide all necessary input and output assignments, signal processing, audio level adjustments, and control programming to provide a complete and fully operational audio system. All equipment shall be tested and adjusted for proper operation.

D. Provide and install an Analog Telephone Adapter (ATA), as necessary, to connect to the Owner's VoIP Telephone System. The ATA set-up and configuration will be provided by the Owner or the Owner's telephone system provider.

2.2 AMPLIFIER

A. Provide one (1) Crown DCi 4|600 DriveCore Install Series four-channel power amplifier. The amplifier shall provide four (4) independent channels of amplification rated at 600 watts per channel with all channels driven into 4-ohm, 8-ohm, 70V, or 100V loads. The amplifier shall incorporate Crown DriveCore technology and shall provide direct-drive 70V/100V outputs without requiring external output transformers. The amplifier shall include four (4) balanced analog audio inputs for connection to the specified Biamp TesiraFORTÉ digital signal processor. The amplifier shall provide independent channel level controls, input sensitivity settings, and front-panel indicators for power, signal presence, clipping, and fault conditions. The amplifier shall incorporate protection circuitry against short circuits, excessive temperature, DC output, and other abnormal operating conditions. The amplifier shall include a universal power supply with power factor correction and a forced-air cooling system. The amplifier shall be suitable for installation in a standard 19-inch equipment rack and shall occupy two (2) rack spaces. The amplifier shall receive audio signals from the central DSP and provide independent amplification for the Paging, Radio Dispatch, and Music Systems. The fourth amplifier channel shall be available for an additional speaker circuit or future system expansion

2.3 BLUETOOTH AUDIO RECEIVER

A. Provide one (1) TASCAM RX-BT10MKII Professional Bluetooth Audio Receiver, or approved equal, to provide wireless audio connectivity from Bluetooth-enabled smartphones, tablets, and other compatible devices to the Music System. The receiver shall incorporate Bluetooth 5.1 Class 1 technology and shall support A2DP and AVRCP Bluetooth profiles and SBC and AAC audio codecs. The receiver shall provide two (2) balanced XLR line-level outputs and two (2) unbalanced RCA line-level outputs with selectable stereo or summed mono operation. The receiver shall have a frequency response of 20 Hz to 20 kHz and a signal-to-noise ratio of 90 dB or greater. The receiver shall include a detachable Bluetooth antenna, front-panel pairing button, Bluetooth connection status indicator, and adjustable audio output level control. The receiver shall support customizable Bluetooth device naming for identification and pairing with authorized user devices. The receiver shall include a remote pairing connection utilizing a two-pin Euroblock connector for connection of an optional remote momentary push-button switch. The receiver shall include a metal enclosure, manufacturer-provided mounting brackets, and an external power supply. The receiver shall be installed in the centrally located audio equipment rack and connected to the Biamp TesiraFORTÉ digital signal processor to provide wireless audio input to the Music System.

2.4 LOUDSPEAKERS

A. Paging System Ceiling Loudspeakers

Provide JBL Control 424C/T ceiling-mounted loudspeakers, or approved equal, at the locations indicated on the drawings. The loudspeakers shall be a 4-inch, two-way coaxial design consisting of a low-frequency driver and high-frequency transducer to provide clear and intelligible voice reproduction. The loudspeakers shall have a nominal coverage pattern

of 130 degrees and shall provide uniform sound distribution throughout the designated coverage areas. The loudspeakers shall include an integral 70V/100V transformer with selectable power taps for connection to the Paging System amplifier circuits. Each loudspeaker shall include a paintable white grille, mounting hardware, and provisions for installation in suspended or finished ceilings. The loudspeakers shall be connected exclusively to the Paging System amplifier channels and shall operate independently of the Radio Dispatch and Music Systems.

B. Radio Dispatch System Ceiling Loudspeakers

Provide JBL Control 424C/T ceiling-mounted loudspeakers, or approved equal, at the locations indicated on the drawings. The loudspeakers shall be a 4-inch, two-way coaxial design with a nominal coverage pattern of 130 degrees, designed to provide clear and intelligible reproduction of radio communications and dispatch audio. The loudspeakers shall include an integral 70V/100V transformer with selectable power taps and shall be equipped with a paintable white grille and mounting accessories suitable for the ceiling construction. The loudspeakers shall provide uniform audio coverage throughout the designated areas and shall be connected to dedicated Radio Dispatch System amplifier channels. The Radio Dispatch System loudspeakers shall operate independently of the Paging and Music Systems.

C. Music System Ceiling Loudspeakers

Provide JBL Control 426C/T ceiling-mounted loudspeakers, or approved equal, at the locations indicated on the drawings. The loudspeakers shall be a 6.5-inch, two-way coaxial design consisting of a low-frequency driver and high-frequency transducer for full-range music reproduction. The loudspeakers shall have a nominal coverage pattern of 110 degrees and shall provide uniform sound distribution throughout the designated coverage areas. The loudspeakers shall include an integral 70V/100V transformer with selectable power taps for connection to the Music System amplifier circuits. Each loudspeaker shall include a paintable white grille, mounting hardware, and provisions for installation in suspended or finished ceilings. The loudspeakers shall be connected exclusively to the Music System amplifier channels and shall operate independently of the Paging and Radio Dispatch Systems..

D. High-Ceiling Pendant Loudspeakers

Provide JBL Control 67HC/T pendant-mounted loudspeakers, or approved equal, at the locations indicated on the drawings. The loudspeakers shall be a commercial-grade, full-range, two-way coaxial design consisting of a 6.5-inch low-frequency driver and a 1-inch high-frequency transducer. The loudspeakers shall provide a nominal 75-degree conical coverage pattern designed to provide uniform sound distribution and improved speech intelligibility in high-ceiling areas and spaces with reflective surfaces. The loudspeakers shall have a frequency response of 75 Hz to 17 kHz, a nominal sensitivity of 93 dB, and a continuous power handling capacity of 75 watts. Each loudspeaker shall include an integral 70V/100V transformer with selectable power taps of 7.5, 15, 30, and 60 watts at 70V. The loudspeakers shall include a durable enclosure, protective grille, and manufacturer-approved suspension hardware consisting of primary and secondary safety cables. The loudspeakers shall be suitable for installation in open-structure ceilings and other designated high-ceiling areas.

The Contractor shall coordinate loudspeaker mounting heights, locations, and transformer tap settings with the Electrical Engineer to provide the required audio coverage.

E. Horn-Type Paging and Dispatch Loudspeakers

Provide AtlasIED APX40TN horn-type loudspeakers, or approved equal, at the locations indicated on the drawings. The loudspeakers shall be commercial-grade, high-efficiency, constant-directivity paging horns suitable for indoor and outdoor applications, including apparatus bays and exterior areas. The loudspeakers shall have a nominal power handling capacity of 40 watts, a frequency response of 400 Hz to 7.5 kHz, and a sensitivity of 107 dB. The loudspeakers shall provide a nominal 60-degree horizontal by 40-degree vertical coverage pattern for controlled sound distribution and clear voice reproduction. Each loudspeaker shall include an integral 25V/70V/100V transformer with selectable power taps of 2.5, 5, 10, 20, 30, and 40 watts at 70V. The loudspeaker enclosure shall be constructed of high-impact, UV-resistant polycarbonate material suitable for exposure to environmental conditions. The loudspeakers shall incorporate an adjustable rotating horn assembly with 15-degree positioning increments to allow precise aiming and coverage adjustment. Each loudspeaker shall include a corrosion-resistant mounting bracket and provisions for installation on walls, structural members, or other designated mounting surfaces. The Contractor shall coordinate loudspeaker mounting locations, aiming, coverage patterns, and transformer tap settings with the Electrical Engineer to provide the required sound pressure levels and speech intelligibility.

F. The Contractor shall furnish and install all loudspeakers, wiring, mounting hardware, supports, and accessories required for a complete installation. Loudspeakers shall be installed at the locations indicated on the drawings and shall be securely mounted in accordance with the manufacturer's recommendations. Each of the three (3) audio systems shall utilize dedicated loudspeakers and amplifier channels. Where multiple systems serve the same room or area, separate loudspeakers shall be provided for each system as indicated on the drawings. The Contractor shall adjust the transformer power taps and amplifier output levels to provide uniform audio coverage and appropriate sound levels throughout the facility. All loudspeakers shall be connected, tested, and adjusted for proper operation.

2.5 EQUIPMENT CABINET

A. Provide one (1) fully welded, wall-mounted equipment cabinet with locking front door to house the central audio system equipment. The cabinet shall be constructed of minimum 16-gauge steel with triple-formed side-to-bottom and side-to-top wrapped construction to provide a rigid and durable enclosure. The cabinet shall incorporate a hinged mounting section to allow access to the rear of the equipment for installation, wiring, and maintenance. The mounting section shall attach to the backbox utilizing heavy-duty, spring-loaded, positive-locking mechanisms. The equipment cabinet shall provide a minimum of twenty-four (24) rack units and shall have a nominal depth of twenty-six (26) inches. The cabinet shall include a locking, perforated front door to provide ventilation while preventing unauthorized access to the equipment. Provide ventilation panels at the top and bottom of the cabinet to facilitate airflow and prevent excessive heat buildup. Provide matching blank panels for all unused rack spaces. The cabinet shall be equipped with one (1) four-space

locking security drawer for storage of system accessories and documentation. The Contractor shall provide all necessary rack shelves, mounting hardware, cable management accessories, and equipment supports required for a complete installation. The equipment cabinet shall be Middle Atlantic Products model DWR-24-26 with VFD-24 perforated front door.

B. Provide all necessary connectors, cables, terminal blocks, mounting hardware, wire management accessories, power supplies, audio interfaces, combiners, switch panels, power distribution accessories, and other miscellaneous equipment required for a complete and operational audio system. The Contractor shall provide all necessary audio connections between the Biamp TesiraFORTÉ digital signal processor, Crown power amplifier, Bluetooth audio receiver, paging microphone, and associated equipment. Provide passive stereo-to-mono summing interfaces where required for connection of stereo audio sources to mono system inputs. All equipment shall be properly mounted, interconnected, and identified. Audio wiring, control wiring, and power wiring shall be neatly arranged and secured within the equipment cabinet. The Contractor shall provide all necessary system programming, configuration, testing, and adjustments to ensure proper operation of the Paging, Radio Dispatch, and Music Systems.

2.6 SURGE PROTECTION AND POWER CONDITIONING

A. Provide one (1) SurgeX Surge Eliminator and Power Conditioner, model SX1120RT, or approved equal. The unit shall be rack-mounted and operate from a 120VAC power source with a nominal load capacity of 20 amperes. The unit shall incorporate advanced surge elimination technology to protect the connected audio equipment against electrical transients and power disturbances. The unit shall provide EMI/RFI noise filtering, inrush current elimination, and catastrophic over/under voltage shutdown protection. The unit shall include visual status indicators for monitoring power and protection conditions. The unit shall be equipped with a grounded power cord and shall provide the necessary receptacles for connection of the audio system equipment. The Contractor shall coordinate the electrical power requirements with the Electrical Engineer and provide all necessary power connections and accessories for a complete installation.

B. Provide one (1) WattBox WB-UPS-OL-1000-8 Online Double Conversion Uninterruptible Power Supply (UPS), or approved equal. The unit shall provide a minimum capacity of 1000VA/1000 watts and operate from a nominal 120VAC, 60Hz power source. The UPS shall incorporate online double-conversion technology to provide continuous, regulated, pure sine wave power with zero transfer time to battery backup in the event of an interruption or failure of the incoming electrical service. The unit shall provide protection against power surges, voltage fluctuations, electrical noise, and other power disturbances. The UPS shall include eight (8) protected AC receptacles, internal rechargeable sealed lead-acid batteries, automatic battery charging, and provisions for connecting external battery expansion modules. The unit shall incorporate an LCD display for monitoring input and output voltage, battery status, load conditions, and system operating status. The UPS shall include audible and visual alarms for power failure, low battery, overload, and fault conditions. The unit shall

provide USB and RS-232 communication ports for system monitoring and management. The UPS shall be suitable for installation in a standard 19-inch equipment rack and shall occupy two (2) rack spaces. The UPS shall provide battery-backed power to the designated audio processing and control equipment to maintain system operation during temporary interruptions of electrical service.

2.7 DESKTOP PAGING MICROPHONE

A. Provide one (1) TOA PM-660U desktop paging microphone, or approved equal, at the location indicated on the drawings. The microphone shall be a commercial-grade, dynamic desktop microphone designed for voice paging and dispatch communications. The microphone shall incorporate a directional pickup pattern to provide clear and intelligible speech reproduction while minimizing unwanted background noise. The microphone shall include a weighted desktop base and an integral push-to-talk switch with provisions for activating an external control circuit. The microphone shall provide a low-impedance audio output suitable for connection to the specified Biamp TesiraFORTÉ digital signal processor. The push-to-talk control shall interface with the DSP through the appropriate control circuitry to activate the microphone input and route announcements to the designated Paging System amplifier channel. The Contractor shall provide all required wiring, connections, interfaces, and DSP programming necessary for proper microphone operation. The microphone shall be TOA PM-660U, or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Comply with all installation parameters provided by the system manufacturer. Installation shall comply with manufacturer's drawings and printed instructions.

B. Identify and label all cables on each end of the cable. Provide wire tags and a cross-reference sheet detailing each cable location.

C. Furnish and install necessary conduit, wiremold, cable trays, pull boxes, outlet boxes, and cable to provide a complete system as herein specified. All wires shall be tested for continuity and freedom of all grounds and short circuits.

D. All output wiring to the system loudspeakers shall be 18 AWG stranded twisted pair minimum.

3.2 SUPERVISION

A. Installation of these systems shall be supervised by a factory trained representative who shall accompany the Owner's representative on an inspection of the entire system and shall demonstrate the entire systems performance.

B. A complete operational test of the entire system shall be performed to demonstrate proper system function in accordance with the specified requirements. Correct any malfunctions within the system where necessary.

3.4 TRAINING

A. Upon acceptance of the system by the Owner, arrangements shall be made to provide a minimum of two (2) hours of training for the Owner's representatives in proper and full potential operation of the system. The training session shall be scheduled through the Electrical Contractor, Construction Manager, Electrical Engineer, and Architect.

B. Provide three (3) complete sets of bound operating instructions including circuit diagrams, part numbers, names, addresses and telephone numbers of parts and equipment sources.

3.5 WARRANTY

A. The Contractor shall provide a system warranty covering the installed system against defects in workmanship, components, and performance, and follow-up support after project completion. The Contractor shall provide a one (1) year written warranty after system acceptance by the Owner.

END OF SECTION 27.5123

SECTION 28.4600 - FIRE DETECTION AND ALARM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fire alarm system and associated components, including control units, related equipment, initiating devices, and notification appliances.

1.2 RELATED REQUIREMENTS

A. Section 07.8400 - Firestopping.

B. Section 08.7100 - Door Hardware:

C. Section 14.2100 - Electric Traction Elevators: For interface with fire alarm system.

D. Section 14.2400 - Hydraulic Elevators: For interface with fire alarm system.

E. Section 21.1300 - Fire-Suppression Sprinkler Systems: For interface with fire alarm system.

F. Section 21.3000 - Fire Pumps: For interface with fire alarm system.

G. Section 26.0519 - Low-Voltage Electrical Power Conductors and Cables: For non-power-limited cables.

H. Section 26.0526 - Grounding and Bonding for Electrical Systems.

I. Section 26.0533.16 - Boxes for Electrical Systems.

J. Section 26.0536 - Cable Trays for Electrical Systems.

K. Section 26.0548 - Vibration and Seismic Controls for Electrical Systems: Requirements for seismic qualification of equipment specified in this section.

L. Section 26.3213 - Engine Generators: For interface with fire alarm system.

M. Section 27.1000 - Structured Cabling: Data cables for fire alarm system IP network connections.

N. Section 27.5116 - Public Address Systems.

O. Section 27.5129.13 - Rescue Assistance Signal Systems: Two-way emergency communication systems for areas of refuge/rescue assistance.

P. Section 28.4614 - Single and Multiple Station Alarms.

1.3 ABBREVIATIONS AND ACRONYMS

A. AHJ: Authorities having jurisdiction.

B. BAS: Building automation system.

C. DMNS: Distributed mass notification system.

D. ECS: Emergency communications system.

E. EoL: End-of-line.

F. EVACS: Emergency voice/audio communication systems.

G. FACU: Fire alarm control unit.

H. HVAC: Heating, ventilation, and air conditioning.

I. IDC: Initiating device circuit.

J. LAN: Local area network.

K. MNS: Mass notification system.

L. NAC: Notification appliance circuit.

M. NPLFA: Non-power-limited fire alarm.

N. PLFA: Power-limited fire alarm.

O. SLC: Signaling line circuit.

P. SOO: Sequence of operation.

1.4 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

C. ASME A17.1 - Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices; 2025.

D. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

F. NECA 90 - Standard for Commissioning Building Electrical Systems; 2024.

G. NECA 305 - Standard for Fire Alarm System Job Practices; 2018.

H. NFPA 3 - Standard for Commissioning of Fire Protection and Life Safety Systems; 2027.

I. NFPA 4 - Standard for Integrated Fire Protection and Life Safety System Testing; 2027.

J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.

L. NFPA 76 - Standard for the Fire Protection of Telecommunications Facilities; 2024.

M. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2027.

N. NFPA 1225 - Standard for Emergency Services Communications; 2022.

O. UL 38 - Standard for Manual Signaling Boxes for Fire Alarm Systems; Current Edition, Including All Revisions.

P. UL 268 - Standard for Smoke Detectors for Fire Alarm Systems; Current Edition, Including All Revisions.

Q. UL 268A - Standard for Smoke Detectors for Duct Application; Current Edition, Including All Revisions.

R. UL 464 - Standard for Audible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories; Current Edition, Including All Revisions.

S. UL 497B - Standard for Protectors for Data Communications and Fire-Alarm Circuits; Current Edition, Including All Revisions.

T. UL 521 - Standard for Heat Detectors for Fire Protective Signaling Systems; Current Edition, Including All Revisions.

U. UL 864 - Control Units and Accessories for Fire Alarm Systems; Current Edition, Including All Revisions.

V. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

W. UL 1480 - Standard for Speakers for Fire Alarm and Signaling Systems, Including Accessories; Current Edition, Including All Revisions.

X. UL 1711 - Amplifiers for Fire Protective Signaling Systems; Current Edition, Including All Revisions.

Y. UL 1971 - Standard for Signaling Devices for the Hearing Impaired; Current Edition, Including All Revisions.

Z. UL 2075 - Standard for Gas and Vapor Detectors and Sensors; Current Edition, Including All Revisions.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate arrangement of equipment with dimensions and clearance requirements of actual equipment.
2. Coordinate placement of devices and notification appliances with potential conflicts or view obstructions.
3. Coordinate work to provide power for equipment at required locations (e.g., smoke dampers, type of actuators, line or local control transformer, zoning, grouping and circuit activations).
4. Coordinate fire suppression systemdevice requirements, monitoring, control, and associated interconnections.
5. Coordinate requirements for branch circuit protection, identification, and shunt trip if applicable.
6. Coordinate kitchen equipment requirements for fire alarm system interconnections based on selected equipment.
7. Coordinate fire alarm system detection and requirements for battery energy storage spaces.
8. Coordinate reflected ceiling plans to avoid conflicting placements; maintain minimum diffuser and detector clearances as indicated.
9. Coordinate drawing indicated locations for fire extinguisher monitoring requirements.
10. Coordinate submittals to confirm equipment and associated components are capable of indicated settings, and manufacturer documentation identifies required compatible product listings.
11. Municipal Alarm Connections: Coordinate requirements for connection with municipality representative.
12. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
13. Radio Transmitter: Coordinate roof location and installation with Architect.
14. Door Hardware: See Section 08.7100 and coordinate, including access control panel locations.
15. Elevators or Escalators: See Division 14.
16. Lighting Controls: See Division 26.
17. Non-Power-Limited Cables: See Section 26.0519.

18. Engine Generators: See Section 26.3213.
19. See Section 01.9113 - General Commissioning Requirements and coordinate for supporting requirements, including support of services not limited to installation checklists, acceptance testing reports, functional testing, and integrated system testing.

B. Preinstallation Meetings:

1. Conduct meeting with facility representative to review devices, notification appliances, and equipment locations.
2. Conduct meeting with facility representative and other related equipment manufacturers to discuss fire alarm system interface requirements.
3. Conduct meeting to review anticipated installation of code-required smoke control requirements, product solutions, and SOO.
4. Convene one week before starting work for review of documented SOO for system applications.

C. Sequencing:

1. Verify exact termination locations required for boxes, enclosures, and equipment.
2. Do not install devices or notification appliances until final surface finishes, painting, and cleaning are complete, unless otherwise required by AHJ.
3. Do not begin installation of conductors and cables until installation of conduit and pathways between termination points is complete.
4. Sequence work to protect cabling (e.g., overspray painting, physical stress, and insulation damage or covering markings).
5. Verify naming convention for equipment identification, including room names and numbers, prior to creation of final drawings, reports, and labels.

D. Scheduling:

1. Arrange access to facility for data collection with facility representative.
2. Where work involves interruption of existing electrical or fire alarm system service, arrange interruption with Owner.
    a. Arrange test start and end with responsible reporting service. Confirm system normal operating mode and record as-found and as-left settings.
    b. Arrange work to disable individual devices or circuits for minimal disruption if possible.
    c. Arrange in accordance with NFPA 72 fire alarm system impairment requirements.
    d. Where required by AHJ, arrange systems or partial system out of service interruption in accordance with requirements of building, life safety, and fire codes (e.g., approved fire watch plus required notifications, tags at each fire department connection and control valve, and AHJ notification when excess hours).

1.6 SUBMITTALS

A. See Section 01.3000 - Administrative Requirements for submittal procedures.

B. Evidence of designer qualifications.

C. Comply with NFPA 72 chapter "Documentation," including noting names of installers, owners, and system classification information.

D. Design Documents: Submit all information required for plan review and permitting by AHJ, including floor plans, riser diagrams, and description of operation.

1. Copy (if any) of list of data required by AHJ.
2. NFPA 72 "Record of Completion", filled out to extent known at time.
3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A, and complete listing of software required.
4. Manufacturer's detailed product data sheet for each component, including wiring diagrams, and circuit length limitations. Catalog pages and product descriptions include ratings, dimensions, finishes, service conditions, and included features.
5. Certification by manufacturer of FACU that system design complies with Contract Documents.
6. Certification by Contractor that system design complies with Contract Documents.

E. Shop Drawings: Submit installation documentation required for plan review and permitting by AHJ, including floor plans showing locations of fire alarm system components, enlarged drawn to identified scale plan view, and riser diagrams.

1. System zone boundaries and interfaces to fire safety systems.
2. Show locations of components, circuits, and raceways; mark components with identifiers used in control unit programming.
3. Include elevations and details of proposed equipment arrangements.
4. Include system interconnection schematic riser diagram showing proposed and approved cable size and type; coordinated with floor plans and describing circuit class, survivability, and application specific information required by NFPA 72.
5. Include typical wiring diagrams for devices, notification appliances, remote indicators, annunciators, remote test stations, and EoL and power supervisory devices.
6. Include requirements and control diagrams for interfacing with other systems.
7. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; standby and spare capacity calculations; notification appliance circuit loop resistance and voltage drop calculations, including spare capacity.
8. List of devices and notification appliances on each SLC, with spare capacity indicated.
9. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
10. Air-Sampling Smoke Detection Systems: Include air-sampling pipe network layout with sampling ports identified; include calculations demonstrating compliance with specified requirements, including spare capacity.
11. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
12. Detailed drawing of graphic annunciators, displays, and interfaces.
13. Certification by either FACU manufacturer or manufacturer of related equipment.
14. Certification by FACU manufacturer that system design complies with Contract Documents.
15. Certification by Contractor that system design complies with Contract Documents.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Evidence of cybersecurity compliance in accordance with NFPA 72.

H. Evidence of installer qualifications.

I. Evidence of maintenance contractor qualifications, if different from installer.

J. Inspection and Test Reports:

1. Submit inspection and test plan prior to closeout demonstration.
2. Submit documentation of satisfactory inspections and tests.
3. Submit NFPA 72 "Inspection and Test," filled out.

K. Operating and Maintenance Data: See Section 01 7800 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:

1. Original copy of NFPA 72 with portions that are not relevant to this project neatly crossed out by hand; label with project name and date.
2. Complete set of specified design documents, as approved by AHJ.
3. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
4. Contact information for firm that will be providing contract maintenance and trouble call-back service.
5. List of recommended spare parts, tools, and instruments for testing.
6. Replacement parts list with current prices, and source of supply.
7. Detailed troubleshooting guide and large scale input/output matrix.
8. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
9. Detailed but easy to read explanation of procedures require recording of system trouble events by qualified personnel, such as when routine testing is being conducted for fire drills and when entering into contracts for building renovations.

L. Project Record Documents: See Section 01 7800 for additional requirements, have one set available during closeout demonstration:

1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
2. "As installed" wiring and schematic diagrams, with final terminal identifications.
3. "As programmed" operating sequences, including control events by device, and updated input/output chart.
    a. ECS: Voice messages by event.

M. Closeout Documents:

1. Certification by manufacturer that system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
2. NFPA 72 "Record of Completion," filled out completely and signed by installer and authorized representative of AHJ.
3. Certificate of Occupancy.
4. Report on training results.

N. Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.

1. See Section 01.6000 - Product Requirements for additional provisions.
2. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data and place in spare parts cabinet.
3. In addition to items in quantities indicated in PART 2, furnish the following:
    a. Tools, software, and documentation necessary to modify fire alarm system using Owner's personnel; minimum modification capability to include addition and deletion of devices,

notification appliances, circuits, and zones, and changes to system description, and operation.

1) ECS: Include same capability for evacuation and instructional messages.

b. One copy of software not resident in read-only-memory.

c. Extra Fuses: Two for each installed fuse; store inside applicable control cabinet.

d. Extra Cabinet Keys: Six spare for each cabinet lock provided; label key number and corresponding cabinet identifier; collect and provide to Owner facility manager.

1.7 QUALITY ASSURANCE

A. Copies of Design Criteria Documents: For duration of project, maintain at project site copy of each referenced document that prescribes execution requirements; bound together. Also, NFPA 72, relevant portions of other applicable codes, and instructions and guidelines of AHJ. Include in submittals upon completion.

B. Designer Qualifications: NICET Level IV (four) certified fire alarm technician or registered fire protection engineer, employed by FACU manufacturer, Contractor, or installer, with experience designing fire alarm systems in jurisdictional area of AHJ.

C. Installer Qualifications: Firm with minimum three years documented experience installing fire alarm systems of specified type and providing contract maintenance service as regular part of their business.

1. Authorized representative of FACU manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
2. Installer Personnel: At least two years of experience installing fire alarm systems.
3. Supervisor: Level IV (four) certified fire alarm technician; furnish name and address.
4. Contract maintenance office located within 50 miles of project site.
5. Certified in the State in which the Project is located as fire alarm installer.

D. Manufacturer Qualifications: Company specialized in manufacturing products specified in this section with at least three years of documented experience.

E. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

F. Product Evaluation and Listing Organization Qualifications: Organization engaged in evaluation of products and services, including those recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL), and acceptable to AHJ.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

B. Do not exceed maximum ambient temperature requirements for batteries at any time, which reduces battery service life. Replace batteries exposed to temperatures in excess of manufacturer's requirements.

C. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

1.9 WARRANTY

A. See Section 01.7800 - Closeout Submittals for additional warranty requirements.

B. Fire Alarm Control Units and Accessory Equipment: Provide minimum 3-year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

C. Fire Alarm Manual Pull Stations: Provide minimum 3-year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

D. Fire Alarm System Detectors: Provide minimum 3-year year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

E. Fire Alarm System Notification Appliances: Provide minimum 3-year year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.1 FIRE ALARM SYSTEM

A. General Requirements:

1. Provide new fire alarm system complying with NFPA 70, NFPA 72, NFPA 90A, and consisting of required equipment, conduit, cabinets, outlet boxes, wiring, connectors, hardware, supports, accessories, components, software, and system programming as necessary for complete operating system that provides functional intent indicated.
2. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
    a. 36 CFR 1191 and ADA Standards.
    b. Requirements of AHJ.
    c. Applicable local codes.
    d. Contract Documents.
    e. NFPA 72; "should" is mandatory; where conflicts between requirements require deviation, identify deviations clearly on design documents.
3. Fire Alarm System Products:
    a. Listed, classified, and labeled as suitable for purpose intended.
    b. Installation Environments: Provide products suitable for their respective indoor and outdoor applications.
    c. Cybersecurity:
        1) Network communication for control or monitoring of system components protects users by data encryption, mutual device authentication, firmware protection, tamper-proof hardware, and authenticated user access.
        2) Modular component fire alarm system maintains valid cybersecurity certificate from National Registered Testing Laboratory (NRTL), renewed annually.
        3) Firmware upgrades incorporate signature receipts to avoid unauthorized access.
        4) Privacy and Security:
            (a) Authorized password protection is required for accessing and modifying system.

(b) User access level control functionality is configurable.
(c) Includes independent firewall protection.
(d) Incorporates user profiles or other means of data preservation and archiving (e.g., historical changes logs for settings of devices, zones, scenes).
(e) Provide similar devices and equipment to maintain same firmware version.

4. Fire Alarm System Design Information:
   a. Building Code: Comply with ICC (IBC).
      1) Principle Occupancy: As indicated on Architect code summary drawings.
      2) Principle Use: As indicated on Architect code summary drawings.
      3) Elevators: As indicated on Architect code summary drawings.
      4) Occupant Evacuation Method: Total building.
      5) Equipment Room Rating: None required.
      6) Fire Suppression System: Fully sprinkled.
         (a) Types:
            (1) Wet-Pipe Sprinklers.
         (b) Elevator Hoistway: Provide detection, actuation, and dedicated annunciation for sprinklered hoistways in accordance with NFPA 72.
   b. NFPA 72 Fire Alarm System Classification: Protected premises.
   c. Smoke and Heat Detector Coverage: Partial or selective coverage in accordance with NFPA 72.
5. Provide fire alarm circuits in accordance with NFPA 70.
   a. Comply with methods of interconnecting FACUs in accordance with NFPA 72 and NFPA 70.
   b. Power Sources:
      1) Comply with requirements for power supplies of emergency systems in accordance with NFPA 70.
      2) Primary: Dedicated branch circuits from facility power distribution system.
      3) Secondary: Storage batteries with capacity to operate system for period specified by NFPA 72.
   c. Wiring and Wiring Methods:
      1) General Requirements:
         (a) Comply with requirements for wiring and wiring methods in accordance with NFPA 70.
         (b) Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum-rated, listed and labeled as suitable for use in return air plenums.
         (c) Special Occupancies: Comply with NFPA 70.
         (d) Comply with NFPA 70 for wire and cable plenum, riser, general-purpose, limited-use, undercarpet, and underground applications.
      2) Fire Alarm Circuits:
         (a) Comply with NFPA 70 for conditions and types required for multiconductor cable systems.

(b) Non-Power-Limited Fire Alarm (NPLFA) Circuits:
(1) Provide dedicated NPLFA non-GFCI branch circuits for fire alarm equipment and marked by red identification in accordance with NFPA 70.
(c) Power-Limited Fire Alarm (PLFA) Circuits:
(1) Provide identification for PLFA circuits in accordance with NFPA 70.

3) Active Smoke Control - System Interfaces:
(a) SLCs to and from fans wired as Class A (daisy-chain loop, with return, with isolation modules installed as indicated, minimum of one per floor).
(b) Install wiring associated with fans, including control wiring, in metallic conduit.
(c) Provide approved two-hour fire-rated protection for components pertaining to stair pressurization fans (e.g., wiring, control interfaces, and hardware).

4) Fire-Rated Cables and Cable Systems:
(a) Performance alternative approved by AHJ.
(b) Provide cable fastening and listing requirements in accordance with NFPA 70. Provide indication of application, use cases, and product make and model for which listing applies.
(c) Provide additional classification suffix marking on cable system; observable by AHJ.

6. Provide pathway class designations and pathway survivability, as defined in NFPA 72.
a. Provide monitoring of conductors and other signaling channels for integrity and circuit performance.
b. Pathway Class Designations:
1) Unless otherwise indicated or required, pathways to meet the following requirements:
(a) SLCs: Class B (star, tee-tap, multi-tap, with no return).
(b) IDCs: Class B (daisy-chain with EoL resistor device installed at end of circuit).
(c) NACs: Class B (daisy-chain with EoL resistor device installed at end of circuit).
(d) Network Communications: Class B.
(e) Other Wiring:
(1) Other life safety control features not covered above (e.g., door holder circuits, elevator recall circuits, fire smoke dampers, and air handling system interfaces), wired as Class D (failsafe, intended operation is performed in event of pathway failure).
(2) Where Class D wiring is not possible due to limitation of equipment, wiring limited to 3-feet between addressable control module and equipment and be installed in metallic conduit.
c. Pathway Survivability:

1) Unless otherwise indicated or required, pathways to meet requirements for Pathway Survivability Level 3 (two-hour rated cable with performance approved by AHJ, building protected by automatic sprinkler system).

7. Spare System Capacity:
   a. SLCs: Minimum 25 percent spare capacity.
   b. NACs: Minimum 25 percent spare capacity.
8. Secondary Power Source - Battery Storage Capacity:
   a. Provide standby (nonalarm) operation sufficient for 24 hours.
   b. Provide additional alarm operation for 15 minutes.
   c. Calculate combined of standby load plus alarm load for overall battery storage capacity requirements, per power supply.
   d. Provide 25 percent additional overall battery capacity correction factor.

B. Fire Alarm System Interfaces and Control Functions:

1. UL 864 listed unless otherwise indicated.
2. Descriptions below are intended to provide means for interface. See project SOOs, narrative, and input/output matrix for execution requirements.
3. Provide initiating devices, interfaces, and control functions for emergency control function interfaces in accordance with NFPA 72.
4. Provide monitoring of interconnected systems. Coordinate notification appliance alternate markings as indicated on drawings.
5. Elevators:
   a. Comply with ASME A17.1.
   b. Elevator Shutoff:
      1) Elevator Machine Room Heat Detector:
         (a) Shut down elevator power prior to hoistway sprinkler activation.
         (b) Locate within 24 inches of each sprinkler in accordance with NFPA 72.
      2) Sprinkler Pressure or Waterflow: Shut down elevator power prior to hoistway sprinkler activation.
      3) For each elevator, provide output signal to stop elevator via addressable relay module and power isolation relay.
   c. Elevator Emergency Recall Operation:
      1) Elevator Lobby, Hoistway, and Machine Room Smoke Detectors: Elevator recall for fire fighters' service.
      2) In each elevator machine room, provide interface for each elevator car or group of elevator cars as determined by AHJ via separate addressable relay modules for each output signal below, where applicable.
         (a) Recall elevator to designated (primary) level.
         (b) Recall elevator to alternate level.
         (c) Smoke detection in elevator machine room (fire fighter's hat light).
6. Fire and Smoke Doors/Shutters/Curtains:
   a. Automatic Fire and Smoke Door/Shutter/Curtain Release:
      1) Provide output signal for release of fire and smoke doors/shutters/curtains via addressable relay module and power isolation relay.

7. Electrically Locked Doors:
    a. Comply with NFPA 72, building code, and life safety code requirements for electrically locked doors.
    b. Lock Power Supplies: Provide independent power supplies.
8. Lighting/Dimming Control Systems:
9. Sound and Audio/Visual Media Control Systems:
    a. System Override:
        1) Provide output signal to override sound and audio/visual media controls via addressable relay module and power isolation relays.
        2) Provide connection to UL 864 listed system interface or interface with system control power where interruption of control power overrides system.
10. Emergency Communication Systems (ECS):
    a. Provide minimum of six monitoring point inputs per system, including associated enhancement systems.
11. Generator Systems:
    a. Provide minimum of three monitoring point inputs per system.
12. Other Interconnected Systems: For systems listed below, provide minimum of two monitoring point inputs each.
    a. Gas Detection Systems: Including providing notification appliances as indicated on plans for NOX - Nitrous Oxide, CO2 - Carbon Dioxide, CO - Carbon Monoxide, and HC - Hydrocarbon.
13. HVAC Systems:
    a. Air Handling Units (AHUs) and Roof Top Units (RTUs):
        1) Provide duct smoke detector on supply side of air stream for units over 2,000 cfm.
        2) Provide duct smoke detector on return side of air stream for units over 15,000 cfm.
        3) Provide remote test station for each duct smoke detector unless explicitly indicated as not required.
        4) Provide output signal to shut down units with at least one duct smoke detector via addressable relay module.
        5) Where fire/smoke dampers are located downstream of unit, provide monitoring point input to determine that unit is not operational and subsequently provide output signal to close such dampers via addressable relay module and power isolation relay.
    b. Energy Recovery Units (ERUs):
        1) Provide duct smoke detector on supply side of air stream.
        2) Provide duct smoke detector on return side of air stream.
        3) Provide remote test station for each duct smoke detector unless explicitly indicated as not required.
        4) Provide output signal to shut down units with at least one duct smoke detector via addressable relay module.
        5) Where fire/smoke dampers are located downstream of unit, provide monitoring point input to determine that unit is not operational and subsequently provide

output signal to close such dampers via addressable relay module and power isolation relay.

c. Remote Test Stations: Provide remote test station for each duct smoke detector unless explicitly indicated as not required. Unless otherwise indicated, use remote test stations only in clean, dry, indoor, nonhazardous locations.

14. Fire/Smoke Dampers:
    a. Provide output signal to close fire/smoke damper via addressable relay module and power isolation relay.
    b. Fire/smoke damper activated by the following method(s); where more than one method is listed see drawings for method used at each location.
        1) By addressable duct smoke detector.
        2) By smoke detector installed within 5 feet of fire/smoke damper air diffuser (in lieu of duct smoke detection), where fire/smoke dampers serve spaces other than corridors or corridors not provided with smoke detection; smoke detectors installed solely for activation of fire/smoke damper programmed as supervisory signal (not alarm) unless otherwise required by AHJ.
        3) By room/area smoke detection (in lieu of duct smoke detection), where area/room is provided with smoke detection throughout and all dampers serving such room/area are activated.

C. Sleeping Areas:

1. Quantity of Sleeping Locations or Units: As indicated on drawings.
2. Devices Within Units:
    a. Use fire alarm system-connected addressable devices for local unit detection/alarm (in lieu of single- and multiple-station alarms) and for building fire alarm event notification.
    b. Local Unit Detection/Alarm:
        1) Provide low frequency sounder bases for detectors (smoke and carbon monoxide as indicated).
        2) Smoke Detector Activation:
            (a) Provide dedicated local unit supervisory signal to fire alarm system (separate from carbon monoxide detection).
            (b) Activate low-frequency sounder bases within same unit to provide NFPA 72-compliant temporal 3 pattern.
            (c) Detector Restoration: Device activation to automatically restore to normal condition when smoke chamber obscuration levels drop below activation threshold.
        3) Carbon Monoxide Detector Activation:
            (a) Provide dedicated local unit carbon monoxide supervisory signal to fire alarm system (separate from smoke detection).
            (b) Activate low-frequency sounder bases within same unit to provide NFPA 72-compliant temporal 4 pattern.
            (c) Detector Restoration: Device activation to latch and only restore to normal condition upon reset command from FACU.

4) Hearing-Impaired Units:
   (a) Provide strobe (either in combination with sounder or separate device) in each legally-defined bedroom (177 cd), each living area (minimum 75 cd), and each bathroom (minimum 75 cd). Interface to dedicated NAC or addressable control module, 24 VDC, supervised.
   (b) Where unit includes both smoke and carbon monoxide detection, provide strobe labeled "ALERT" in lieu of "FIRE."
5) Synchronize notification appliances (sounders and strobes) within unit with each other.
6) Exclude local unit detection/alarm from any fire alarm system bypass/disable operation.

c. Building Fire Alarm Event Notification:
1) Provide low frequency sounders in each unit as indicated and as required to achieve minimum of 75 dB at pillow in legally-defined bedrooms and 15 dB over ambient in other interior areas of unit.
2) In lieu of providing separate low frequency sounders, system may activate detector low frequency sounder bases provided under local unit detection/alarm above.
3) Hearing-Impaired Units: Use strobe provided for local unit detection/alarm above.
4) Synchronize notification appliances (sounders and strobes) within unit with each other and with common area notification appliances on same floor.
5) FACU to control activation mapping, silencing, and restoration.

2.2 FIRE ALARM CONTROL UNITS AND RELATED EQUIPMENT

A. Manufacturers:

1. Honeywell International, Inc; Honeywell Gamewell-FCI: www.honeywell.com/#sle.
2. Honeywell International, Inc; Honeywell Notifier: www.honeywell.com/#sle.
3. Potter Electric Signal Company: www.pottersignal.com/#sle.
4. Silent Knight.
5. Substitutions: See Section 01.6000 - Product Requirements.
6. Source Limitations: Furnish FACUs and related equipment produced by single manufacturer and obtained from single supplier.

B. Fire Alarm Control Units and Related Equipment: Listed and labeled as complying with UL 864.

C. Provide cabinets and enclosures as indicated or as required to house system components.

D. Fire Alarm Control Unit (FACU): Addressable.

1. SLCs and IDCs: Configurable for Class B or Class A with additional modules.
2. NACs: Integral and programmable with synchronization modules or cards as required.
3. Power Supply: 120 VAC, 60 Hz, supplying necessary power for FACU.
4. User-Interface: Touchscreen display for system interfacing and service mode settings, include password and user credentials; configurable for custom actions and incorporates historical event log.
5. Support self-testing detector capability.

6. Remote Annunciator Support: Up to 10.
7. Provide NAC expansion as required.
8. Networking: Copper media.
9. Enclosure Finish Color: Red.

E. Basis of Design - Addressable Fire Alarm Control Unit: Potter Electric Signal Company; IPA Series; Model IPA-4000; www.pottersignal.com/#sle.

1. System Capacity: 4,064 addresses; six (expandable to 192) notification appliance circuits (NACs); four input/output (I/O) circuits; 1,500 software zones.
2. Features: Strobe synchronization; dedicated alarm, supervisory and trouble relays; 4,000 event history buffer; built-in IP communicator; Ethernet port for programming and network connectivity; e-mail system status, reports and event information.

F. Notification Appliance Circuit Expansion:

1. Where notification appliance circuit requirements exceed capacity of FACU, provide accessories and cabinets as required for expansion.

G. Networking:

1. Comply with NFPA 70.
2. FACU capable of communicating over network utilizing peer-to-peer, inherently regenerative communication and format.
3. Provide network repeaters as required.
4. Networks with Copper Media:
   a. Provide surge protection for wiring that leaves structure.

H. Emergency Communications System (ECS):

1. Comply with NFPA 1225.
2. Amplifiers listed and labeled as complying with UL 1711.
3. FACU Listed for ECS:
   a. Provide digital ECS integrated with FACU and capable of automatic and manual paging, messaging, evacuation, and alerting on selective and all-call basis.
   b. Provide all-call and total evacuation necessary switch points of command, manual controls of evacuation and paging, per zone, prerecorded messaging for nonemergency voice notifications, door unlock provisions, and commands for speaker bypass, unless otherwise approved by Engineer and AHJ.
   c. Provide minimum of six switch points of command for speaker bypass, visual bypass, elevator recall bypass, door control bypass, HVAC bypass, and auxiliary bypass.
   d. Local and Remote Transponders:
      1) Audio hardware, including multiple primary and backup amplifiers, speaker circuit interfaces, power supplies, supervision hardware, cabinets, and battery backup systems may be configured to support multiple notification zones and packaged as audio transponders.
      2) Transponders considered system control equipment and located, installed, and interfaced accordingly.

I. Releasing Service:

1. Provide FACU listed for releasing service, UL 864.
2. Provide addressable releasing control modules as indicated or as required for control of solenoids listed for releasing applications.
3. Provide manual releasing stations for suppression system activation as indicated.
4. Provide alarm bells for audible notification as indicated. Interface to dedicated NAC or addressable control module, 24 VDC, supervised. Default operation march time pattern on activation of first event, continuous tone on release.
5. Provide strobes for visible notification as indicated. Interface to dedicated NAC or addressable control module, 24 VDC, supervised. Default operation flash on activation of first event, flash on release.
6. FACU capable of supporting 10 releasing zones for independent hazards, with each zone capable of three cross-zone and four abort options; provide adjustable delay and discharge timers.
7. Provide momentary red push button abort switches as indicated with stainless steel wallplate and identify "SUPPRESSION SYSTEM ABORT."
8. Addressable Releasing Control Modules: See "Addressable Interface Modules" below.
9. Manual Release Station: See "Manual Pull Stations" under "Initiating Devices" article below.
10. Bells and Strobes: See "Notification Appliances" article below.

J. Active Smoke Control:

1. Provide FACU listed for active smoke control, UL 864.
2. Provide panels listed to UL 864 for smoke control use as indicated or as required for annunciation and manual override. Panels that use separate components not listed for smoke control use as assembly are not permitted.
3. Provide LED graphical annunciator and fire fighter's override panel at locations indicated on drawings.
4. Provide smoke control system report printing capability via fire alarm system printer.
    a. Fire Alarm System Printer: See "Fire Alarm System Printers" below.
    b. Capable of producing ACTIVE and ACTIVE CLEAR reports for points related to smoke control system.
    c. Capable of producing PASS and FAIL reports for weekly test of smoke control system. If present, indicate cause of failures (e.g., fan timeout) for diagnostic purposes.
5. Fan Control/Indication:
    a. Provide HAND/OFF/AUTO selector switch for each fan to permit manual override control.
    b. Provide white NORMAL indication to identify each selector switch is in AUTO position.
    c. Provide green ON and red OFF indication to identify operating status of each fan.
    d. Provide amber FAULT indication to identify abnormal condition for each fan or associated control hardware.
    e. Where applicable, provide blue DUCT SMOKE indication to identify fans that have been deactivated by duct smoke detectors to permit manual override control to ON with selector switch.
6. Damper Control/Indication:
    a. Provide OPEN/AUTO/OFF selector switch for each damper to permit manual override control.
    b. Provide white NORMAL indication to identify each selector switch is in AUTO position.

c. Provide green OPEN and red CLOSED indication to identify operating status of each damper.
d. Provide amber FAULT indication to identify abnormal condition for each damper or associated control hardware.

7. Where fan and damper are to operate in unison, provide single selector switch and NORMAL indication for combined control. Provide separate annunciation points for other specified indications.
8. Provide master engage key-operated switch to enable panel operation.
   a. When switch is in ENGAGE position and any fan/damper selector switch is placed in position other than AUTO, generate fault at FACU to indicate that smoke control system manual mode has been initiated.
   b. Restore to normal condition when selector switches have been returned to AUTO position or when ENGAGE switch is returned to NORMAL position.
9. Provide local lamp test/acknowledge switch to confirm operation of each lamp and to silence local panel fault indicating sounder; switch to operate with panel master engage key switch in either ENGNAGED or NORMAL position.
10. If more than one panel is required, each panel to be programmable to permit equal operational feature at each panel. Command of panels determined by programmable priority sequence assigned to each panel.

K. Addressable Interface Modules:

1. General Requirements:
   a. Provide addressable modules suitable for connection to FACU SLCs.
   b. Unless otherwise indicated, use addressable modules only in clean, dry, indoor, nonhazardous locations.
2. Addressable Monitor Modules: Unless devices are explicitly permitted connected together on one zone; provide separate addressable monitor module for each conventional dry-contact input device in order to be individually identifiable by addressable FACU.
3. Addressable Relay Modules:
   a. Provide as indicated or as required to perform necessary functions via dry-contact interface.
   b. Where load exceeds module contact rating, provide accessory power isolation relays suitable for load as required.

L. Alarm Communication:

1. Protected Premises Alarm and Signaling Systems:
   a. Provide accessories as required for interface as indicated and as required by AHJ.
   b. Provide accessories in accordance with building code, fire code, and life safety code requirements for occupancy classifications and use cases.
   c. Include software and firmware control, required features, special requirements for low-power radio (wireless) systems, and fire alarm system interconnections required by NFPA 72.
2. Supervising Station Alarm Systems:

a. Provide accessories as required for interface with supervising station as indicated and as required by AHJ.
b. Communication Method: Single path, internet protocol (IP).
c. Supervise communication paths at interval required by NFPA 72.

3. Public Emergency Alarm Reporting Systems:
   a. Provide accessories as required for interface as indicated and as required by AHJ.
   b. Provide municipality-approved master box with quantity of interface zones, coding, and timing as required by AHJ.
   c. Interface with FACU utilizing supervised wiring to relay modules with quantity of contacts as required for interface zones.
4. Products:
   a. NAPCO Security Technologies, Inc; StarLink Max Series Cellular Communicators: www.napcosecurity.com/#sle.
   b. Substitutions: See Section 01.6000 - Product Requirements.

M. Remote Annunciators:

1. LCD Remote Annunciators:
   a. Provide backlit LCD display that mimics FACU display.
   b. Provide dedicated status indications for power and alarm, supervisory, and trouble conditions.
   c. Enable system control functions including acknowledge, silence, and reset.
   d. Provide local audible alarm.
   e. Mounting: Wall-mounted; provide flush-mounted annunciator for finished areas and surface-mounted annunciator for non-finished areas unless otherwise indicated.
2. LED Remote Annunciators:
   a. Provide LEDs each with customizable label for displaying alarm, supervisory, and trouble conditions.
   b. Mounting: Wall-mounted; Provide flush-mounted annunciator for finished areas and surface-mounted annunciator for non-finished areas unless otherwise indicated.

N. Fire Alarm System Printers:

1. Listed to UL 864 for use with fire alarm system.
2. Capable of providing written record of system events and status changes.

2.3 FIRE ALARM SYSTEM INITIATING DEVICES

A. General Requirements:

1. Addressable Systems:
   a. Addressable Devices: Individually identifiable by addressable FACU; suitable for connection to FACU SLCs.
   b. Conventional/Nonaddressable Devices: Provide addressable interface modules as indicated or as required for connection to addressable FACU. Unless devices are explicitly

permitted to be connected together as one zone, provide separate addressable monitoring point for each device in order to be individually identifiable by addressable FACU.

2. Provide devices and associated accessories suitable for intended application and location to be installed. Unless otherwise indicated, use addressable devices and addressable interface modules only in clean, dry, indoor, nonhazardous locations.
3. Surface-Mounted Devices: Provide manufacturer's accessory surface mount backboxes or suitable outlet/device box.
4. Devices for Outdoor and Damp/Wet Locations: Weatherproof, suitable for outdoor use; provide manufacturer's accessory backboxes or enclosures in accordance with product listing.
5. Devices for Hazardous/Classified Locations: Listed and labeled as suitable for classification of installed location.

B. Manual Fire Alarm Boxes/Pull Stations:

1. Description: Noncoded manual signaling boxes listed and labeled as complying with UL 38.
2. Alarm Initiation: Configured for general alarm initiation unless otherwise indicated; presignal stations (where indicated) require use of key to initiate general alarm.
3. Operation: Dual-action unless otherwise indicated or required.
   a. Dual-Action Operation: First requires pushing, pulling, or lifting, then pulling of lever.
4. Color: Red, in accordance with NFPA 72.
5. Station Reset: Requires use of key or tool.

C. Spot-Type Detectors:

1. Utilize plug-in mounting to separate base with tamper-resistant feature; provide bases as indicated or as required.
2. Addressable Detectors:
   a. Provide LED indication of normal operation and regular communication with FACU and alarm condition.
3. Smoke Detectors:
   a. Listed and labeled as complying with UL 268.
   b. Provide sensor type (e.g., photoelectric, ionization) as indicated.
4. Thermal/Heat Detectors:
   a. Listed and labeled as complying with UL 521.
   b. Provide sensor type (e.g., fixed temperature, rate-of-rise) and rating as indicated.
5. Carbon Monoxide Detectors:
   a. Listed and labeled as complying with UL 2075.
   b. Provide end-of-life notification.

D. Duct Smoke Detectors:

1. Listed and labeled as complying with UL 268A.
2. Ratings: Compatible with air velocity, temperature, and humidity requirements for installed duct.
3. Housing: Select as required for application.
4. Sampling Tubes: Select as required for installation in duct to be monitored.

E. Beam Smoke Detectors:

1. Listed and labeled as complying with UL 268.
2. Provide reflective type (with transmitter/receiver unit and separate reflector) or end-to-end type (with separate transmitter and receiver units) detectors.

3. Provide minimum of four configurable automatic detection sensitivity levels.
4. Select detectors and associated accessories suitable for coverage range required.
5. Finish Color: Selected by Architect.

F. Air-Sampling Smoke Detection Systems:

1. Design and provide smoke detection system suitable for application and coverage area indicated, consisting of smoke detector unit with aspirator/fan that continuously draws air into sensing chamber through connected sampling pipe network and associated sampling ports.
2. Comply with NFPA 72 and list and label as complying with UL 268.
3. Comply with applicable requirements of NFPA 76 for Very Early Warning Fire Detection (VEWFD).
4. Detector Unit:
   a. Sensitivity: Programmable; capable of meeting NFPA 76 requirements for Very Early Warning Fire Detection (VEWFD) even if system is designed and programmed for less stringent level.
   b. Smoke Detection Method: Provide detector units employing laser-based light scattering mass detection.
   c. Alarm Levels: Programmable; as indicated or as required to perform alert, prealarm action, and alarm functions; minimum of three.
   d. Minimum Number of Output Relays Supported: _____.
   e. Display: Provides local annunciation of detector trouble and alarm status.
5. Sampling Pipe Network:
   a. Use manufacturer's recommended sampling pipe and fittings; plenum rated; identified in accordance with NFPA 72.
   b. Designed using manufacturer's product-specific design software or based on manufacturer's pre-engineered design suitable for application.
6. SLC Interface: Communicates levels of events; allows FACU real-time status information, resetting of historical values, and initiating operating modes.

2.4 FIRE ALARM SYSTEM NOTIFICATION APPLIANCES

A. General Requirements:

1. Provide signaling notification appliances listed for fire-protective service and intended operating mode, public or private; suitable for connection to FACU notification appliance circuits.
2. Provide notification appliances and associated accessories suitable for intended application and location to be installed. Use notification appliances only according to listed mounting (e.g. ceiling, wall).
3. Surface-Mounted Notification Appliances: Provide manufacturer's accessory surface mount backboxes or suitable outlet/device box.
4. Concealed Notification Appliances:
   a. Upon activation from fire alarm system, expose device for operation; return to concealed position upon system deactivation; motor-driven.
   b. Provide door position monitoring system for remote indication of concealed and exposed positions.
5. Exterior Notification:
   a. In addition to required occupant notification, provide notification appliances on exterior of building.

b. Outdoor and Damp/Wet Locations: Weatherproof, suitable for outdoor use; provide manufacturer's accessory backboxes or enclosures in accordance with product listing.
c. Visible Notification: Provide strobe beacon with red lens; interface to dedicated NAC or addressable control module, 24 VDC, supervised.
d. Trouble Visible Notification: Provide strobe beacon with amber lens; interface to dedicated NAC or addressable control module, 24 VDC, supervised.
e. Sprinkler System Waterflow Visible Notification: Provide strobe beacon with clear lens; interface to dedicated NAC or addressable control module, 24 VDC, supervised; same circuit as sprinkler system waterflow audible notification where provided.
f. Sprinkler System Waterflow Audible Notification: Provide bell; interface to dedicated NAC or addressable control module, 24 VDC, supervised; same circuit as sprinkler system waterflow visible notification where provided.

6. Notification Appliance Derating: Include device derating adjustments in accordance with listing where applicable, including the following.
   a. Where accessory protective guards or enclosures are utilized.
   b. Where required by field conditions (e.g., ambient temperature and sound).
7. Notification Appliance Color:
   a. Wall-Mounted: Red.
   b. Ceiling-Mounted: White.
   c. See drawings for mounting configuration indicated by symbols on floor plans, system interconnection diagrams, and details.

B. Visible Notification Appliances:

1. Public Mode Operation: Listed and labeled as complying with UL 1971.
2. Strobes: Clear or nominal white lens with flash rate of 1 Hz unless otherwise indicated or required; xenon or LED light source with maximum pulse duration of 0.02 seconds; candela rating as indicated.

C. Audible Notification Appliances:

1. Listed and labeled as complying with UL 464.
2. Rated Sound Pressure Level: As required to achieve design sound pressure levels, but not less than 75 dBA at 10 feet for public mode operation or 45 dBA at 10 feet for private mode operation in accordance with UL 464.
3. Horns: Selectable tone, including at minimum NFPA 72 temporal 3 pattern and continuous; minimum of two selectable volume levels.
4. Low-Frequency Sounders: Listed for producing 520 Hz low frequency alarm signal for sleeping areas in accordance with NFPA 72; selectable tone, including at minimum NFPA 72 temporal 3 pattern and continuous.

D. Textual Audible Notification Appliances:

1. Listed and labeled as complying with UL 1480.
2. Rated Sound Pressure Level: As required to achieve design sound pressure levels, but not less than 75 dBA at 10 feet for public mode operation or 45 dBA at 10 feet for private mode operation in accordance with UL 464.
3. Frequency Range: 400 to 4,000 Hz minimum in accordance with UL 1480; listed for producing 520 Hz low frequency alarm signal for sleeping areas in accordance with NFPA 72.

4. Loudspeakers:
   a. Listed as suitable for installed environment.
   b. Speaker Voltage: Field configurable, matched to audio distribution circuit voltage.
   c. Provide minimum of four field-selectable power taps.

E. Combination Notification Appliances: Comply with respective requirements for each signaling method.

F. Accessories:

1. Notification Appliance Bases: White, unless otherwise indicated.
2. Provide guards to protect notification appliances where subject to mechanical damage; listed for use with notification appliance.

2.5 WIRE AND CABLE

A. General Requirements:

1. Substitution of fire alarm listed cables for communication wiring, in accordance with NFPA 70, is not permitted.
2. Provide cables as indicated or as required for connections between system components.
   a. Data Cables for IP Network Connections: Unshielded twisted pair (UTP) complying manufacturer's minimum requirements.
   b. See Section 27.1000.

B. Power-Limited Fire Alarm Cables (PLFA):

1. Comply with applications of listed cables in accordance with Chapter 7 of NFPA 70.
   a. Fire alarm cable substitutions in accordance with NFPA 70: Permitted.

C. Non-Power-Limited Fire Alarm Cables (NPLFA):

1. Comply with NPLFA circuit conductor properties in accordance with NFPA 72.
2. Comply with listing requirements in Chapter 7 of NFPA 70.

2.6 ACCESSORIES

A. Provide components as indicated or as required for connection of fire alarm system to devices and other systems indicated.

B. Provide EoL resistors as required for wiring supervision.

C. Terminal Cabinets:

1. Cabinet: Steel, with red finish; keyed to match fire alarm system equipment.
2. Terminal Strips: Rated for 20 A at 250 VAC.
3. Termination Points: Rated for 12 AWG conductors; quantity as indicated on drawings or as required for application with minimum 25 percent spare capacity.

D. Protective Covers for Fire Alarm Devices:

1. Listed to same standard as device being protected.
2. Outdoor Covers: Weather resistant, suitable for outdoor use; use only with outdoor-rated devices.
3. Provide guards to protect devices where subject to mechanical damage; listed for use with detector.

a. Protective Covers for Manual Pull Stations:
   1) Provide protective covers with hinged access for manual pull stations where indicated.
   2) Listed and labeled as complying with UL 38.
   3) Outdoor Covers: Weather resistant, suitable for outdoor use; use only with outdoor rated devices.
   4) Provide integral battery-powered horn activated by lifting cover where indicated for false alarm deterrent.
b. Protective Covers for Detectors:
   1) Use only with specific devices approved under listing.

E. Documentation Cabinets:
   1. Provide cabinets, size as indicated or as required to comply with on-site documentation storage required by NFPA 72.
      a. Quantity of Cabinets: As indicated on drawings.
   2. Cabinet: Steel with red finish; keyed to match fire alarm system equipment unless otherwise required by AHJ.

F. Surge Protection:
   1. Line Voltage Surge Protection:
      a. Provide for each line voltage circuit serving fire alarm system control units and related equipment (e.g., FACU, field booster panels, nodes, and transponders).
      b. Listed and labeled as complying with UL 1449.
   2. Low Voltage Surge Protection:
      a. Provide for each power-limited fire alarm circuit that enters or exits a building.
      b. Listed as complying with UL 497B.
      c. Provide voltage/current ratings suitable for circuit to be protected.

G. Battery Tester:
   1. Provide listed equipment rated for VDC, VAC, and fire alarm system maximum amperage capacity, in-rush conditions, and correction factors.
   2. Provide battery analyzer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify field measurements, including future system expansion as indicated on Contract Documents.

B. Verify that system capacities listed in manufacturer instructions align with designed system.

C. Verify that mounting surfaces are ready to accept components and equipment, with suitable support frames and anchors installed where required.

D. Verify ratings, configurations, and characteristics of system components.

E. Verify rough-ins for field connections.

F. Verify that work likely to damage fire alarm system has been completed.

G. Verify that interior of building has been protected from weather.

H. Perform preinstallation tests and inspections per manufacturer's instructions and in accordance with NECA 305.

I. Verify that system bonding is in accordance with Section 26.0526.

J. Do not energize system until deficiencies have been corrected.

K. Verify that branch circuit wiring installation is completed, tested, and ready for connection to fire alarm system. Overcurrent protection ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

3.2 PREPARATION

A. Prior to installation, confirm environment of installation area is clean, and with ambient temperature, humidity, and ventilation requirements are per manufacturer’s written instructions.

1. Clean and vacuum in accordance with manufacturer's written instructions. Confirm equipment ventilation holes are absent of obstructions and free for air flow.
2. Clean pathways thoroughly to remove foreign materials before installing conductors and cables.
3. Clean dirt, debris, plaster, and other foreign materials from equipment enclosures, cabinets, and outlet boxes.
4. Clean surfaces to receive adhesive products according to manufacturer's instructions.

B. Follow tool requirements for installation, including torquing adjustments, as listed in manufacturer documentation.

C. Remove detector dust covers prior to system energization.

3.3 INSTALLATION

A. Install field-devices, components, FACU and related equipment, and accessories in accordance with the following:

1. Manufacturer's instructions, applicable codes, and Contract Documents.
2. NECA 1.
3. NECA 305.
4. NFPA 70; including requirements for mechanical execution of work.

B. Field Locations:

1. Obtain Owner's approval of locations of devices and notification appliances before installation.
2. Arrange equipment to provide minimum operational clearances and required maintenance access in accordance with manufacturer's instructions and NFPA 70.
3. Conceal wiring, conduit, outlet boxes, and supports where installed in finished areas; maintain code-required access.

C. Raceways and Supports:

1. Coordinate locations of outlet boxes as required for installation. Only install boxes and equipment at locations based on application standards indicated in NFPA 72.
   a. See Section 26.0533.16.

2. Secure and support raceways at intervals complying with NFPA 70. Provide supports where vertical rise exceeds permissible limits.
   a. See Section 26.0529.
3. Provide minimum of six spare 1-inch trade size conduits out of each fire alarm panel stubbed into accessible space above ceiling.
4. Install firestopping to preserve fire resistance rating of partitions and other elements.
   a. Minimum height for pathways to pass through floor or wall, if cable fastening is required, and routing in elevator hoistways in accordance with NFPA 70.
   b. See Section 07.8400.
5. Provide required vibration isolation or seismic controls.
   a. See Section 26.0548.
6. Cable Trays: Coordinate non-power-limited fire alarm and other Class 1 circuits utilizing cable tray for support for maximum conductors in cable trays and raceways; including ampacity adjustment factors in accordance with NFPA 70.
   a. Cable Tray Support and Attachment: See Section 26.0536 for additional requirements.

D. Wiring and Connections:

1. Maintain separation of Class 1, Class 2, Class 3 remote-control, signaling, fire alarm circuits, and power-limited circuits in accordance with cable insulation class and NFPA 70.
2. Maintain circuit pathway and class designations in accordance with NFPA 72 for configuration, separation, and survivability.
3. Comply with permitted and not permitted installations for wires, cables, cable routing assemblies, communications circuits, and fire alarm circuits in accordance with NFPA 70.
4. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by AHJ. Provide independent support from building structure and suspended ceiling systems. Do not provide support from raceways, piping, ductwork, or other systems.
5. Provide grounding and bonding in accordance with Section 26.0526.
6. Comply with manufacturer's minimum cable sizes or ratings.
7. Do not exceed manufacturer's recommended maximum power, signal, or network cable lengths between components.
8. Provide network wiring in accordance with NFPA 70.
9. Neatly train and bundle conductors inside boxes, wireways, and cabinets.
10. Fire-Rated Cables and Cabling Systems: Comply with listing requirements to maintain installation, including aspects of attachment surfaces, specific products, and requirements associated with vertical and horizontal routing.
11. See manufacturer's instructions for batteries.

E. Fire Alarm System Components:

1. Install field-installed devices, components, relays, notification appliances, accessories, and when applicable EoL resistors.
   a. Install wiring to supervisory devices and associated EoL resistors as required for supervision of hardwired connections
2. Install Wall-Mounted Equipment: Assemble component hardware within (e.g., card bays, sub-bays, expansion bays, signal cards, other card frames, networking, signal transmission, application modules, tamper monitoring devices, interconnecting modules, and auxiliary power supplies), including space for required spare capacity, and configure settings.

3. Install Interconnect Wiring: Connect system cabinets, install processor and cards, cabling, connectors, terminations, and bonding.

F. Branch Power:

1. After installation confirmations, follow manufacturer instructions to connect branch circuit power cables to premises fire alarm system components; comply with NFPA 70.
2. Where accessories require auxiliary power, provide control power source and monitoring as indicated or as required to complete installation.
3. Install auxiliary power supplies, including indicated monitoring, and connections necessary for remote equipment.

G. System Identification:

1. Identify devices, notification appliances, components, cables, and equipment in accordance with approved submittals. See Section 26.0553.
2. Confirm fire alarm system programming meets requirements of SOO and sub-system SOOs.
3. Mark location of disconnecting means for NPFLA circuits.
4. Coordinate to provide red branch power circuit protective devices or identify them accordingly as required by NFPA 72 and NFPA 70.
5. Mark date of batteries installed on inside cover of panels and formal maintenance logs.

H. Troubleshooting and Installer Checks:

1. Field test connectivity periodically during installation process to avoid unexpected troubleshooting.
2. Check system operation for notification, FACU functions, circuit supervision, alarm initiating devices, supervisory initiating devices, dress panels/doors/covers, and programming before performing field tests.

I. Fire Alarm System Tests:

1. Perform required tests of NFPA 72. Record measured values during operational checks.
2. Confirm functional testing of fire alarm system is as indicated in Contract Documents.

3.4 FIELD QUALITY CONTROL

A. See Section 01.4000 - Quality Requirements for additional requirements.

B. Provide services of manufacturer's authorized representation to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's detailed testing procedures and field reports and with submittals.

C. Provide equipment, two-way radios for testing personnel use, tools, and supplies required to accomplish inspection and testing.

D. Notify Owner and Architect at least two weeks prior to scheduled inspections and tests.

E. Inspect and test in accordance with manufacturer's instructions.

F. Inspect wiring and components for damage and defects.

G. Batteries and Power Supplies: Perform inspections and tests listed in manufacturer installation instructions.

H. Perform additional requirements related to testing and inspection during system startup.

I. Test for interface with other systems.

J. Test shunt trips to verify operation.

K. Correct defective work, adjust for operation, and retest until entire system complies with Contract Documents.

L. Submit detailed reports indicated inspection and testing results, corrective actions taken, and as-found and final adjusted settings.

M. Diagnostic Period: After successful completion of inspections and tests, operate system to normal mode for at least 14 days without system or equipment malfunctions.

3.5 SYSTEM STARTUP

A. Obtain Owner approval prior to performing system startup.

B. Manufacturer Services: Provide services of manufacturer's authorized representation to systems startup. Include manufacturer's detailed startup procedures with submittals.

C. Prepare and start equipment and systems in accordance with manufacturer's instructions and recommendations.

3.6 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust initiating device and notification appliance settings to achieve desired operation as indicated in submittals.

C. Measure power supply primary and secondary voltages, log values for records, and make appropriate adjustments.

D. Adjust alignment of equipment covers and doors. Provide keys and spare keys to Owner.

E. Reprint and reinstall damaged or misinstalled labels; maintain neat and square to installed location good workmanship - see NECA 1; maintain consistent placements for identification on products of similar type.

F. Adjust devices or notification appliances and associated bases to be flush and level.

G. Program system parameters according to requirements of Owner.

3.7 CLEANING

A. See Section 01.7000 - Execution and Closeout Requirements for additional requirements.

B. See Section 01.7419 - Construction Waste Management and Disposal for field-generated construction waste requirements.

C. Check tightness of electrical connections. Replace damaged components and provide closure plates for vacant positions. Provide circuit directory updates for related power branch circuits.

D. Clean and repair existing materials and equipment that remain or are indicated for reuse.

E. Clean dirt, debris, plaster, and other foreign materials from outlet boxes and fire alarm system equipment and components.

F. Clean fire alarm system equipment and components according to manufacturer's instructions and NECA 305.

G. Clean surfaces and interiors of boxes and device cover plates in accordance with manufacturer's instructions to remove dirt, fingerprints, debris, plaster, and other foreign materials.

H. Repair scratched or marred exposed surfaces to match original factory finish.

I. Comply with federal (EPA), state, and local regulations for battery handling and disposal. Do not spill battery fluids down plumbing drains. Only use containers safe for transportation marked 'nonspillable.'

3.8 COMMISSIONING

A. See Section 01.9113 - General Commissioning Requirements for additional requirements.

B. Comply with NFPA 3 for commissioning of fire protection and life safety systems.

C. Comply with NECA 90 for commissioning building electrical systems.

D. Support Commissioning Agent in assembling test data and generating reports.

E. Comply with requirements for testing as required by Commissioning Agent for Integrated System Testing.

1. Comply with NFPA 4 for integrated fire protection and life safety system testing.

F. Participate in four hours of seasonal testing, as scheduled by Commissioning Agent, six months from Date of Substantial Completion.

3.9 INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner 7 days prior to beginning completion inspections and tests.

B. Owner will provide services of an independent fire alarm engineer or technician to observe tests and approve closeout documentation.

C. Notify AHJ and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

D. Provide services of installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

E. Prepare for testing by ensuring that work is complete and correct; perform preliminary tests as required.

F. Provide tools, software, and supplies required to accomplish inspection, testing, and document results.

G. Perform inspection and testing in accordance with NFPA 72 and requirements of AHJ; document each inspection and test.

H. Correct defective work, adjust for operation, and retest until entire system complies with Contract Documents.

I. Diagnostic Period: After successful completion of inspections and tests, operate system in normal mode for at least 14 days without system or equipment malfunctions.

1. Record system operations and malfunctions.
2. If malfunction occurs, start diagnostic period over after correction of malfunction.
3. Owner will provide attendant operator personnel during diagnostic period; schedule training to allow Owner personnel to perform normal duties.

4. At end of successful diagnostic period, fill out and submit NFPA 72 "Inspection and Testing Form."

3.10 OWNER PERSONNEL INSTRUCTION

A. Provide the following instruction to designated Owner personnel:

1. Hands-On Instruction: On-site, using operational system.
2. Classroom Instruction: Owner furnished classroom, on-site or at other local facility.
3. Factory Instruction: At FACU manufacturer's authorized training facility.

B. Administrative: One-hour session(s) covering issues necessary for nontechnical administrative staff; classroom:

1. Initial Training: One session precloseout.
2. Refresher Training: One session post-occupancy.

C. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:

1. Initial Training: One session precloseout.
2. Refresher Training: one session post-occupancy.

D. Detailed Operation: Two-hour sessions for engineering staff; assume NICET level I qualifications or equivalent; combination of classroom and hands-on:

1. Initial Training: One session precloseout.
2. Refresher Training: One session post-occupancy.

E. Maintenance Technicians: Detailed training for electrical technicians on programming, maintaining, repairing, and modifying; factory training:

1. Initial Training: One 3-day session, precloseout.
2. Refresher Training: One 1-day session post-occupancy.

F. Use operation and maintenance documentation as primary instruction material; have paper copies available for attendees and supplement training material aids.

G. Provide means of evaluation of trainees suitable to type of training given; report results to Owner.

3.11 CLOSEOUT ACTIVITIES

A. See Section 01.7800 - Closeout Submittals for additional submittals.

B. See Section 01.7900 - Demonstration and Training for additional requirements.

C. Closeout Demonstration: Demonstrate operation of all functions to Owner.

1. Be prepared to conduct any of required tests.
2. Have minimum one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
3. Have authorized technical representative of FACU manufacturer present during demonstration.
4. Demonstration may be combined with inspection and testing required by AHJ; notify AHJ with enough time to schedule demonstration.
5. Repeat demonstration until successful.

D. Occupancy will not occur prior to Substantial Completion.

E. Substantial Completion of project cannot be achieved until inspection and testing is successful and the following:

1. Specified diagnostic period without malfunction has been completed.
2. Approved operating and maintenance data has been delivered.
3. Spare parts, extra materials, and tools have been delivered.
4. All aspects of operation have been demonstrated to Owner.
5. Final acceptance of fire alarm system has been given by AHJ.
6. Occupancy permit has been granted.
7. Specified precloseout instruction is complete.

F. Perform post-occupancy instruction within three months after Substantial Completion.

3.12 PROTECTION

A. Protect installed fire alarm system from subsequent construction operations.

3.13 MAINTENANCE

A. See Section 01.7000 - Execution and Closeout Requirements for additional requirements relating to maintenance service.

B. Provide to Owner as alternate to base bid separate maintenance contract for service and maintenance of fire alarm system for entire warranty period to include work described below; include complete description of preventive maintenance, systematic examination, adjustment, inspection, and testing, with detailed schedule.

C. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:

1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
2. Repairs required, unless due to improper use, accidents, or negligence beyond control of maintenance contractor.
3. Record keeping required by NFPA 72 and AHJ.

D. Provide trouble call-back service upon notification by Owner:

1. Provide on-site response within two hours of notification.
2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
3. Owner will pay for call-back service outside of normal working hours on hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

E. Provide complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with detailed schedule.

F. Maintain on-site log listing date and time of each inspection and call-back visit, condition of system, nature of trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.

G. Comply with Owner's requirements for access to facility and security.

END OF SECTION 28.4600

SECTION 28 46 11.25 - AIR SAMPLING DETECTION SYSTEM FOR LITHIUM ION BATTERY OFF GASSING

PART - 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 STANDARDS

A. The system shall be designed, installed, commissioned & maintained to meet the county specific recommendations. All normative references for this document shall be considered.

B. System conformity shall be tested & approved according to UL 268 standard for smoke detectors used in fire alarm systems.

Class	Sensitivity	Description
A	Aspirating smoke detector providing very high sensitivity	Very early warning fire detection: (VEWFD) NFPA 76 The detection of very diluted amounts of smoke, for example entering air conditioning return air ducts to detect the extremely diluted concentrations of smoke that may be emanating from overheating electrical equipment in the protected space (i.e. clean room, server room)
B	Aspirating smoke detector providing enhanced sensitivity	Early warning fire detection: (EWFD) NFPA 76 For special fire detection arrangements, close to uniquely valuable, vulnerable or critical items such as medical analysis equipment, computers, Lithium-ion energy storage or electronic equipment cabinets
C	Aspirating smoke detector providing normal sensitivity	Standard fire detection: (SFD) NFPA 72 General fire detection in normal rooms or spaces, giving, for example, at least an equivalent level of detection as a point or beam type smoke detection system

Tab. 1. Smoke detection classification table NFPA.

All fire detection & control equipment shall be Listed for their functions to the relevant parts of NFPA 72. Certificate of conformance according to the relevant NFPA codes & standards shall be provided.

The electrical installation shall be installed & tested in accordance with NFPA 70 (NEC) & any applicable local codes of practice. Design guidance as well as installation supervision shall be supplied by an authorized Siemens dealer with at least 10 years' experience in the installation of Air aspirating type detection. The qualified dealer for this project shall be Berkshire System Group, Inc.

Please contact Jed Richardson, jrichardson@bsgi, at BSGI for any questions and application specific installation practices.

1.3 SUMMARY

A. Scope

This specification describes a highly sensitive LED-based dual wavelength smoke detector using aspirated air sampling. The analog detecting device shall be conventional ASD. It shall be in full compliance with all applicable codes and standards. The features and capacities described in this specification are required as a minimum for this project and shall be furnished by the successful contractor.

The system shall support pre-engineered sampling pipe network designs with verified hydraulic calculations in addition to custom sampling pipe network designs using a computer based hydraulic design modeling tool. Sample pipe network material shall be approved to local codes and standards for use in air sampling smoke detection systems.

The system shall be in full compliance with North American standards and country specific codes.

The system shall include all required hardware, raceways, interconnecting wiring and software to accomplish the requirements of this specification and the contract drawings, whether or not specifically itemized herein.

All equipment furnished shall be new and the latest state-of-the-art products of a single manufacturer engaged in the manufacturing and sale of analog fire detection devices.

The system as specified shall be supplied, installed, tested, and approved by the local Authority Having Jurisdiction, and turned over to the owner in an operational condition.

In the interest of job coordination and responsibilities the installing contractor shall contract with a single supplier for fire alarm equipment, engineering, programming, inspection and tests, and shall be capable of providing UL, VdS, and certificates for the complete system.

The system specified shall be that of a Fire Safety Company which meets the project requirements. Other systems shall be submitted 10 days prior to bid date for approval by the Engineer. All systems approved shall meet all the requirements spelled out in this specification. System approval shall be in writing by the Engineer of record, and a copy shall be submitted with the system submittals.

1.4 QUALIFICATIONS

A. The fire detection system supplier will be a company with a minimum of 10 years' experience in fire detection. BSGI is the authorized supplier to meet these requirements.

1.5 SYSTEM DESCRIPTION

A. Summary

1. Aspirating smoke detectors are used for early warning detection of smoke-generating fires in rooms and equipment. They are particularly suited to applications in which point detectors are pushed to their limits, cannot be used, or not preferred.
2. The aspirating smoke detectors shall use dual-wavelength (blue and infrared) technology to trigger an alarm at the earliest possible moment. Aspirating smoke detectors continually extract air from the room being monitored using a connected

pipe network system with defined aspirating holes. The extracted air is fed into a uniquely designed detection chamber, in which minute smoke particles are detected by scattered light.

B. Basic system features

The detector shall consist of an air sampling pipe network to transport air to the detection system and support pre-engineered designs. Complex designs shall be supported by hydraulic calculations from a computer-based design-modeling tool.
The detector shall consist of a highly sensitive LED-based smoke detector and an aspirator.
The smoke-density threshold necessary to active the various alarm states shall be programmable (in percentage obscuration per foot)
The detector shall have a USB-compatible serial control port for the purpose of configuration, control, status monitoring, event log extraction and upgrade.
The detector shall be capable of working in stand-alone applications, whereby the various alarm states cause the corresponding relay output contacts to be activated.

C. Alarm states and other status indicators.

1. It shall be possible to configure the required smoke density thresholds for the corresponding detection alarm levels:
   a. Info alarm
   b. Pre-alarm
   c. Fire 1
   d. Fire 2

D. Networking

1. The detector shall be capable of communicating operational status with a fire protection panel via contact monitor modules communicating over the detector bus. The network shall support up to 252 devices. PC based and App based configuration tools shall be available to configure and manage the detector.

E. System configuration

1. A USB compatible serial port shall be provided to enable configuration, status monitoring, command input, event log extraction and software upgrades. It shall comply with EIA USB Protocol. The detector may be configured by a Windows PC (via a USB cable).
2. A smartphone app shall also be provided to support a semi-automated commissioning process, enabling the configuration data to be transmitted directly to the detector via a wireless (Bluetooth) connection. No manual entry of the configuration data shall be required.

F. Serviceability

1. On-site replacement of either the aspirator or the detection chamber shall be possible, without having to replace the entire assembly.

1.6 SUBMITTAL

A. The contractor shall include the following information with their offer:

Product data for detector, piping, supports, and accessories.
Piping layout showing sampling point locations, pipe routing, and detector unit location.
Air sampling pipe network calculations (carried out using a hydraulic modeling program), which specify the following performance criteria:

a. Smoke Transport Time
   The manufacturer's recommended transport time (i.e. the time between the smoke entering the pipe and it reaches the detector) from the least sample point on each pipe run shall meet NFPA 72 and product Listing requirements.
b. Balance %
   The sample point balance for the pipe shall not be less than 70% (as indicated by the manufacturer's hydraulic modeling program). That is, the volume of air drawn from the last sampling point shall not be less than 70% of the average volume of air through the other sample holes.
c. Share %
   The sample hole share for the pipe shall not be less than 70% (as indicated by the manufacturer's hydraulic modeling program). That is, the sum volume of air drawn through the sampling holes must always be greater than 70% of the total volume of air entering the pipe (i.e. the End Vent must not exceed 30% of the total flow).

A copy of the manufacturer's installation, operation and maintenance manuals shall be supplied upon completion of the installation.
System commissioning data shall be supplied (in a format recommended by the manufacturer and per the instructions provided by the manufacturer) within 30 days of completion of the installation.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications

The specified aspiration detection system for Lithium-Ion battery off gassing equipment is manufactured by Siemens as supplied, programmed and commissioned by BSGI. No substitutions will be permitted.
Classification for aspirating smoke detection UL 268 Standard for Safety for Smoke Detectors for Fire Alarm Signaling Systems.

The manufacturer shall be certified as meeting ISO 9002 for manufacturing.

B. Supplier Qualifications

Provide the services of a factory trained and certified representative or technician, experienced in the installation and operation of the type of system provided. The qualified representative is Berkshire Systems Group, Inc. Please contact Jed Richardson for more information: jrichardson@bsgi.com.
The technician shall supervise installation, software documentation, adjustment, preliminary testing, final testing, and certification of the system. The technician shall provide the required instruction to the owner's personnel in system operation and maintenance.
The supplier shall furnish evidence they have an experienced service organization, which carries a stock of spare and repair parts for the system being furnished.

The equipment supplier shall be authorized and trained by the manufacturer to calculate, design, install, test, and maintain the air sampling system and shall be able to produce a certificate stating such upon request.

C. Installer Qualifications:

Before commencing work, the contractor shall submit data showing that the manufacturer has successfully installed fire alarm systems of the same scope, type and design as specified.
The contractor shall submit copies of all required Licenses and Bonds as required in the Country having jurisdiction.
The contractor shall be qualified to certify fire alarm systems. Upon completion of the installation the contractor shall certify that the final system meets the county regulations for ongoing maintenance.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Products shall be delivered to the project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, and shelf life (if applicable).

B. Materials shall be stored inside, under cover, above ground, and kept dry and protected from physical damage until ready for use. Wet or damaged materials shall be removed from the project site and discarded.

1.9 PROJECT CONDITIONS

A. Installed products or materials shall be free from any damage including, but not limited to, physical insult, dirt and debris, moisture, and mold damage.

B. Environmental Limitations: Products or materials shall not be delivered or installed until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and a temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.10 WARRANTY

A. The contractor shall provide a warranty for the entire system for electrical & mechanical failures for one year. The warranty shall begin on completion of the acceptance certificate.

B. Maintenance Contract

The fire alarm system manufacturer or subcontractor shall offer for the owner's consideration at the time of submittal a priced inspection, maintenance test & repair contract complying with country regulations.

C. Technical Support

Beginning with Substantial Completion, software support shall be provided for a minimum period of 1 years.

PART 2 - PRODUCTS

Subject to compliance with requirements all equipment shall be from an approved supplier. The listed equipment shall be supplied, no substitutions permitted.

2.1 DEVICE TYPES

A. A range of aspirating smoke detectors shall be available, enabling system optimization in accordance with site-specific requirements. As a minimum, detectors shall be available that are UL Listed to UL 268 standard to cover the following areas:

1. Up to 5,000 ft^2

Specified product: SIEMENS FDA422

Up to 10,000 ft^2

Specified product: SIEMENS FDA442

Up to 15,000 ft^2

Specified product: SIEMENS FDA461

Up to 21,500 ft^2

Specified product: SIEMENS FDA462

B. Common basic features

The detectors may be used as stand-alone devices connected to a fire protection control unit via the detector bus. In the latter case the devices shall transmit the alarm and status information to the connected fire protection panel and receive corresponding commands (e.g. ACK and Reset) from the panel.

The detectors will continually draw in air through a pipe system via aspirating holes. The air shall be fed into a uniquely designed smoke detection chamber, in which minute smoke particles are detected by scattered light.

It shall be possible to adjust the sensitivity of the detectors (measured in percentage obscuration per foot) for each of the alarm status levels (Info alarm, Pre-alarm, Fire 1, and Fire 2).

In addition to the programmable fire alarm sensitivities, the detector will have three modes of operation: Automatic; Ultra-Sense; and Robust.

- "Automatic": for standard applications (e.g. large public buildings, museums, warehouses).
- "Ultra-sense": for applications with low dust load, where the fastest possible fire detection is needed and no deceptive phenomena are expected (e.g. clean rooms, server rooms and manufacturing).
- "Robust": for applications with a high level of dust suppression in harsh environments with deceptive phenomena (e.g. industrial areas, recycling plants and sawmills).

The LED based detection chamber shall be of the mass light scattering type and capable of detecting a wide range of smoke particle types of varying size. A dual wavelength technology shall be used to:

a. prevent large particles from affecting the true smoke density reading
b. monitor contamination of the detection chamber (dust & dirt etc.) to automatically notify when the chamber has been contaminated and maintenance is required.

The detection chamber shall be designed to minimize any soiling of the optical measuring path, hence keeping the critical detector optics clean and preventing internal detector contamination.

The detector shall not use adaptive algorithms to adjust the sensitivity from that set during commissioning.

All detector types shall have an integrated short-circuit isolator when connected to the detector bus.

C. Device type designed for up to 5,000 ft^2

Specified product: SIEMENS FDA422

In addition to the common features described above, this device shall also provide the following:

Detector features

1. The ASD shall be UL Listed to cover up to 5,000 ft^2.
2. The Info alarm, Pre-alarm, Fire 1 and Fire 2 smoke density thresholds shall be freely configurable within the range of 0.002 to 6.096 %/ft obs.
3. The time delays for each of the alarm thresholds shall be freely programmable between zero and 300 seconds.
4. A non-volatile event memory shall be provided with time and date stamp. It shall have separate event log storage for smoke levels, alarm conditions, operator actions and faults. As a minimum, the event log shall support up to 40,000 entries.
5. The ASD shall be VdS approved to detect lithium-ion battery off-gas particles during the "pre-thermal runaway" period of battery failure.

Operation and display

As a minimum, the front panel user interface shall provide the following elements:

1. Independent high intensity alarm indicators for:
   a. The four alarm levels: Info alarm; Pre-alarm; Fire 1; Fire 2
   b. Fault
   c. Power
   d. Connection status (Bluetooth connection to smartphone for configuration purposes)
   e. Alarm Setup and Airflow Setup
   f. Dust

A silence buzzer / LED-test button

Restricted access to the following functions shall be available to authorized personnel:

1. Normalization of airflow and smoke-density (used during commissioning).

Reset detector status indicators, including the associated output relays.
(N.B. **only** when the detector is operating in stand-alone mode).

Inputs/Outputs

1. Three programmable relay outputs (NO/NC, latching/non-latching) shall be provided (e.g. for Pre-alarm, Fire 1 and Fire 2).

A dedicated (normally closed) relay output shall be provided for Fault.

Three general-purpose monitored inputs shall also be provided to trigger one of the following optional actions:

a. Switching to 'Manned' / 'Unmanned' (NB only possible when the detector is operating in stand-alone mode)
b. Reset
c. Activation of the blowing-out unit
d. Deactivation of all relays and alarm outputs

As a minimum, the following optional modules shall be available.

e. A 4…20 mA card with 2 analog outputs, which can be configured to represent smoke-density alarm levels, airflow rates, dust values, or fine dust values.

   Specified product: SIEMENS FDAZ296

f. A relay card with 6 freely programmable relay outputs, which can be mapped to reflect the status of any of the alarm levels.

   Specified product: SIEMENS FDAZ295

Technical Details:

• Standards	NFPA 72, NFPA 76, NFPA 70; IEC 62443-4-1; IEC 62443-4-2
• IP-rating	IP30
• Operating temperature	32 °F – 120 °F (0 °C to +49 °C)
• Relative humidity	5…95 % (no moisture condensation)
• Approvals	UL-268, VdS; TÜV SÜD

D. Device type designed for up to 10,000 ft^2

Specified product: SIEMENS FDA442

In addition to the common features described above, this device shall also provide the following:

Detector features

1. The ASD shall be UL Listed to cover up to 10,000 ft^2.
2. The Info alarm, Pre-alarm, Fire 1 and Fire 2 smoke density thresholds shall be freely configurable within the range of 0.001 to 6.096 %/ft obs.
3. The time delays for each of the alarm thresholds shall be freely programmable between zero and 300 seconds.
4. A non-volatile event memory shall be provided with time and date stamp. It shall have separate event log storage for smoke levels, alarm conditions, operator actions and faults. As a minimum, the event log shall support up to 40,000 entries.

5. The ASD shall be VdS approved to detect lithium-ion battery off-gas particles during the "pre-thermal runaway" period of battery failure.

Operation and display

As a minimum, the front panel user interface shall provide the following elements:

1. Independent high intensity alarm indicators for:
    a. The four alarm levels: Info alarm; Pre-alarm; Fire 1; Fire 2
    b. Fault
    c. Power
    d. Connection status (Bluetooth connection to smartphone for configuration purposes)
    e. Alarm Setup and Airflow Setup
    f. Dust

A silence buzzer / LED-test button

Restricted access to the following functions shall be available to authorized personnel:

1. Normalization of airflow and smoke-density (used during commissioning).

Reset detector status indicators, including the associated relays.
(N.B. **only** when the detector is operating in stand-alone mode).

Inputs/Outputs

1. Three configurable relay outputs (NO/NC, latching/non-latching) shall be provided (e.g. for Pre-alarm, Fire 1 and Fire 2).

A dedicated (normally closed) relay output shall be provided for Fault.

Three general-purpose monitored inputs shall also be provided to trigger one of the following actions:

a. Switching to 'Manned' / 'Unmanned' (NB only possible when the detector is operating in stand-alone mode)
b. Reset
c. Activation of the blowing-out unit
d. Deactivation of all relays and alarm outputs

As a minimum, the following optional modules shall be available.

e. A 4…20 mA card with 2 analog outputs, which can be configured to represent smoke-density alarm levels, airflow rates, dust values, or fine dust values.

    Specified product: SIEMENS FDAZ296

f. A relay card with 6 freely programmable relay outputs, which can be mapped to reflect the status of any of the alarm levels.

    Specified product: SIEMENS FDAZ295

Technical Details:

- Standards NFPA 72, NFPA 76 and NFPA 70
  IEC 62443-4-1; IEC 62443-4-2

- IP-rating IP30
- Operating temperature 32 °F – 120 °F (0 °C to +49 °C)
- Relative humidity 5…95 % (no moisture condensation)
- Approvals UL 268, VdS; TÜV SÜD

E. Device type designed for up to 15,000 ft^2

Specified product: SIEMENS FDA461

In addition to the common features described above, this device shall also provide the following:

Detector features

1. The ASD shall be UL Listed to cover up to 15,000 ft^2.
2. The Info alarm, Pre-alarm, Fire 1, and Fire 2 smoke density thresholds shall be freely programmable within the range of 0.002 to 6.096 %/ft obs.
3. The time delays for each of the alarm thresholds shall be freely programmable between zero and 300 seconds.
4. A non-volatile event memory shall be provided with time and date stamp. It shall have separate event log storage for smoke levels, alarm conditions, operator actions and faults. As a minimum, the event log shall support up to 40,000 entries.
5. The ASD shall be VdS approved to detect lithium-ion battery off-gas particles during the "pre-thermal runaway" period of battery failure.

Operation and display

As a minimum, the front panel user interface shall provide the following elements:

1. Independent high intensity alarm indicators for:
   a. The four alarm levels: ~~I~~nfo alarm; Pre-alarm; Fire 1; Fire 2
   b. Fault
   c. Power
   d. Connection status (Bluetooth connection to smart phone for configuration purposes)
   e. Alarm Setup and Airflow Setup
   f. Dust

A silence buzzer / LED-test button

Restricted access to the following functions shall be available to authorized personnel:

1. Normalization of airflow and smoke-density (used during commissioning).
2. Reset all the detector's status indicators, including the associated relays. (N.B. **only** when the detector is operating in stand-alone mode).

Inputs/Outputs

1. Three programmable relay outputs (NO/NC, latching/non-latching) shall be provided (e.g. for Pre-alarm, Fire 1 and Fire 2).

A dedicated (normally closed) relay output shall be provided for Fault.

Three general-purpose monitored inputs shall also be provided to trigger one of the following actions:

a. Switching to 'Manned' / 'Unmanned' (NB only possible when the detector is operating in stand-alone mode)
b. Reset
c. Activation of the optional blowing-out unit
d. Deactivation of all relays and alarm outputs

As a minimum, the following optional modules shall be available:

e. A 4…20 mA card with 2 analog outputs, which can be configured to represent smoke-density alarm levels, airflow rates, dust values, or fine dust values.

   Specified product: SIEMENS FDAZ296

f. A relay card with 6 freely programmable relay outputs, which can be mapped to reflect the status of any of the alarm levels.

   Specified product: SIEMENS FDAZ295

Technical details:

• Standards	NFPA 72, NFPA 76, NFPA 70; IEC 62443-4-1; IEC 62443-4-2
• IP-rating	IP30
• Operating temperature	32 °F – 120 °F (0 °C to +49 °C)
• Relative humidity	5…95 % (no moisture condensation)
• Approvals	UL 268, VdS; TÜV SÜD

F. Device type designed for up to 21,500 ft^2

Specified product: SIEMENS FDA462

In addition to the common features described above, this device shall also provide the following:

Detector features

1. The ASD shall be EN approved to cover up to 21,500 ft^2.

The Info alarm, Pre-alarm, Fire1 and Fire 2 smoke density thresholds shall be freely programmable within the range of 0.001 to 6.096 %/ft obs

The time delays for each of the alarm thresholds shall be freely programmable between zero and 300 seconds.

2. A non-volatile event memory shall be provided with time and date stamp. It shall have separate event log storage for smoke levels, alarm conditions, operator actions and faults. As a minimum, the event log shall support up to 40,000 entries.
3. The ASD shall be VdS approved to detect lithium-ion battery off-gas particles during the “pre-thermal runaway” period of battery failure.

Operation and display

As a minimum, the front panel user interface shall provide the following elements:

1. Independent high intensity alarm indicators for:
   a. The four alarm levels (Info alarm; Pre-alarm; Fire 1; Fire 2)
   b. Fault
   c. Power
   d. Connection status (Bluetooth connection to smart phone for configuration purposes)
   e. Alarm Setup and Airflow Setup
   f. Dust

A silence buzzer / LED-test button

Restricted access to the following functions shall be available to authorized personnel:

1. Normalization of airflow and smoke-density (used during commissioning).
2. Reset detector's status indicators, including the associated relays.
   (N.B. **only** when the detector is operating in stand-alone mode).

Inputs/Outputs

1. Three configurable relay outputs (NO/NC, latching/non-latching) shall be provided (e.g. for Pre-alarm, Fire 1 and Fire 2).

A dedicated (normally closed) relay output shall be provided for Fault.

Three general-purpose monitored inputs shall also be provided to trigger one of the following actions:

   a. Switching to 'Manned' / 'Unmanned' (NB only possible when the detector is operating in stand-alone mode)
   b. Reset
   c. Activation of the optional blowing-out unit
   d. Deactivation of all relays and alarm outputs

As a minimum, the following optional modules shall be available:

   e. A 4…20 mA card with 2 analog outputs, which can be configured to represent smoke-density alarm levels, airflow rates, dust values, or fine dust values.

      Specified product: SIEMENS FDAZ296

   f. A relay card with 6 freely programmable relay outputs, which can be mapped to reflect the status of any of the alarm levels.

      Specified product: SIEMENS FDAZ295

Technical details:

- Standards — NFPA 72, NFPA 76, NFPA 70; IEC 62443-4-1; IEC 62443-4-2
- IP-rating — IP30
- Operating temperature — 32 °F – 120 °F (0 °C to +49 °C)
- Relative humidity — 5…95 % (no moisture condensation)
- Approvals — VdS; TÜV SÜD

2.2 DETECTOR ASSEMBLY

The detector, aspirator and relay outputs shall be housed in an enclosure and shall be arranged in such a way that air is drawn from the fire risk area and a sample passed through the detector by the aspirator.

A. Major features

1. The modular design shall enable the detection chamber and the aspirator unit to be replaced in situ (without having to replace the entire assembly)
2. The display can be rotated through 180° to facilitate alternative installation positions.
3. The detector shall have a single detection chamber and an internal flow sensor. Both high flow and low flow faults shall be reported.
4. The detector shall have two independent detection chambers with separate internal flow sensors for each inlet. Both high flow and low flow faults shall be reported.
5. The aspirator shall be capable of supporting a single pipe run of up to 164 ft or a maximum total length of 410 ft for the entire pipe system (or as local codes dictate).
6. The aspirator shall be capable of supporting a single pipe run of up to 394 ft or a maximum total length of 984 ft for the entire pipe system (or as local codes dictate).
7. The aspirator shall be capable of supporting a single pipe run of up to 164 ft per air inlet, or a maximum total length of 820 ft for the entire pipe system (or as local codes dictate).
8. The aspirator shall be capable of supporting a single pipe run of up to 394 ft, per air inlet, or a maximum total length of 1,968 ft for the entire pipe system (or as local codes dictate).

2.3 POWER SUPPLY AND BATTERIES

A. The system shall be powered from a regulated supply of nominally 24V DC. The battery charger and battery shall comply with the relevant codes, standards, or regulations. Typically, 24 hours standby battery backup is required followed by 15 minutes in an alarm condition.

B. Local Power Supply Standards may apply, for example:

UL 864 listed (provided the power supply and standby batteries have been appropriately sized/rated to satisfy the system power requirements).

2.4 SAMPLING PIPE DESIGN

A. Sampling Pipe

The sampling pipe shall be smooth bore. Typical sample pipe with an outside diameter of 1.05” (25 mm) and internal diameter of 0.87” (21 mm) should be used.

The pipe material shall be approved by North American and local regulation rated CPVC Air Sampling Pipe and otherwise be suitable for the environment in which it is installed, or of material as required by the Specifying Body.

All joints in the sampling pipe must be airtight and made by using solvent cement, except at detector inlet pipe & exhaust pipe entries to the detector.

The pipe shall be identified as Air Sampling/Aspirating Smoke Detector Pipe (or similar wording) along its entire length at regular intervals not exceeding the manufacturer's recommendation or that of local codes and standards.

All pipes should be supported at intervals of not more than 5 ft. (1.5 m) or at a distance described in local codes and standards.

The far end of each trunk or branch pipe shall be fitted with an end cap made air-tight by using solvent cement. The use of an end vent will be dependent on pre-engineered pipe design or hydraulic modeling program calculations. Optionally, a test point can be used at the end of each pipe run to facilitate test smoke (test aerosol) entry during smoke transport time tests.

B. Sampling Points

Sampling holes shall not be separated by more than the maximum distance allowed for conventional point detectors as specified in the local codes and standards. Intervals may vary according to calculations. For NFPA 72 the maximum allowable distance is 30 ft (10 m).

Each sampling point port shall be identified in accordance with Codes or Standards.

Consideration shall be given to the manufacturer's recommendations and standards in relation to the number of sampling points and the distance of the sampling points from the ceiling or roof structure and forced ventilation systems.

Sample port size shall be as specified by pre-engineered design requirements or by modeling program hydraulic calculations for the custom sampling pipe networks.

PART 3 - EXECUTION

3.1 THE DETECTION SYSTEM

A. The contractor shall install the system in accordance with the manufacturer's System Design Manual.

3.2 THE CAPILLARY SAMPLING NETWORK

A. Where false ceilings are installed, the sampling pipe shall be installed above the ceiling, and capillary sampling points shall be installed on the ceiling and connected by means of a capillary tube.

B. The minimum internal diameter of the capillary tube shall be 0.25” – 0.50” the maximum length of the capillary tube shall be 10 ft unless the manufacturer in consultation with the engineer have specified otherwise.

C. The capillary tube shall terminate at a ceiling sampling point specifically designed and approved by the manufacturer. The performance characteristics of the sampling points shall be considered during the system design.

3.3 AIR SAMPLING PIPE NETWORK CALCULATIONS

A. Pre-engineered pipework setups are provided in the ASD Product Guide. For specific performance requirements that fall outside the pre-engineered designs, a sampling pipe hydraulic calculation program shall provide air sampling pipe network calculations. Pipe calculations shall be supplied together with the proposed pipe layout design to indicate the performance criteria.

1. The manufacturer’s recommended transport time (i.e. the time taken by test smoke (aerosol) sampled at test point on the end of each pipe run to reach the detector) shall meet NFPA 72 and local standards and detector Listings.

Local codes and standards may also apply, for example NFPA 76 (VEWFD, EWFD).
The maximum transport time must never exceed the local codes of detector Listings.

3.4 SYSTEM CHECKS

A. All pipes shall be visually checked to ensure that all joints, fittings, bends, sampling points, etc., comply with the specification.

B. The system shall be checked to ensure the following features are operational and programmed in accordance with the specification.

1. Alarm threshold levels (for both day and night settings)

Clock and date
Time delays
Air flow fault thresholds
Extra buttons operable (Reset/Isolate)
Units set to Imperial
Additionally:

1. All ancillary warning devices shall be checked to ensure correct operation.

The interconnection with the Fire Alarm Control Panel shall be checked to ensure correct operation.

3.5 TESTS

A. Introduce Smoke into the Detector Assembly to provide a basic functional test.

B. Introduce smoke to the last sample hole or dedicated test point on each pipe run. Transport time shall be checked against calculations made using the manufacturer's hydraulic calculation program and should not exceed NFPA 72 and detector Listings, local codes.

C. Activate the appropriate Fire Alarm zones and advise all concerned that the system is fully operational. Fill out the logbook and commissioning report accordingly.

3.6 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.7 INSTALLATION

A. The installation shall be in accordance with the local codes of practice and conform to the National requirements.

B. Surface cabling should be neatly run and securely fixed at suitable intervals in accordance with the manufacturer's recommendations and NFPA 70 (NEC).

C. Junctions in cables, other than those within equipment enclosures should be avoided wherever possible – follow NFPA 70 (NEC).

D. Where a cable passes through an external wall it should be contained in a smooth bore sleeve of metal or other non-hygroscopic material sealed into the wall. This material will slope downwards towards the outside and should be sealed with a suitable fire-stopping / waterproof compound.

E. Where cables, conduits or trunking pass through floors, walls, partitions, or ceilings the surrounding hole shall be made good with a fire stopping material with sufficient fire resistance to maintain the integrity of the construction.

F. Each junction box will include the legend "Fire Alarm System" on its cover.

G. All wires shall be provided with an identifying permanent label within 2" (50 mm) of its termination.

H. A consistent color code for fire alarm conductors shall be used throughout the installation.

I. Wiring within enclosures will be arranged to allow accessibility to equipment for adjustment & maintenance.

3.8 BOXES, ENCLOSURES AND WIRING DEVICES

A. Boxes shall be installed plumb and firmly in position.

B. Extension rings with blank covers shall be installed on junction boxes where required.

C. Junction boxes served by concealed conduit shall be flush mounted.

D. Upon initial installation, all wiring outlets, junction, pull and outlet boxes shall have dust covers installed. Dust covers shall not be removed until wiring installation when permanent dust covers, or devices are installed.

E. "Fire alarm system" decal or silk-screened labels shall be applied to all junction box covers.

3.9 CONDUCTORS

A. Each conductor shall be identified as shown on the drawings. Permanent wire markers shall be attached within 2” (5 cm) of the wire terminations. Marker legends shall be visible.

B. All wiring shall be supplied and installed in compliance with the local codes of practice and the manufacturer’s requirements.

C. Wiring for strobe and audible circuits shall be a minimum 14 AWG (1.5 $mm^{2)}$, signal line circuits 18 AWG (1.0 mm^2), twisted.

D. All splices shall be made using solderless connectors. All connectors shall be installed in conformance with the manufacturer’s recommendations.

E. Crimp-on type spade lugs shall be used for terminations of stranded conductors to binder screw or stud type terminals. Spade lugs shall have upset legs and insulation sleeves sized for the conductors.

F. The installation contractor shall submit for approval prior to installation of wire, a proposed color code for system conductors to allow rapid identification of circuit types.

G. Wiring within sub panels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance.

3.10 DEVICES

A. Relays and other devices to be mounted in auxiliary panels shall be securely fastened using DIN rails or other mechanically stable methods.

B. Wiring within enclosures shall be arranged to allow accessibility to equipment for adjustment & maintenance.

C. All devices shall be mounted to (or in) a suitable electrical box.

3.11 IDENTIFICATION

A. All conductors shall be labeled at both ends with permanent alphanumeric wire markers.

B. A consistent color code shall be used for fire alarm system conductors throughout the installation.

3.12 COMMISSIONING TESTS

A. The contractor shall allow the manufacturer's representative to attend commissioning of the entire installation in the presence of the owner and/or their representative.

B. All necessary instrumentation, equipment, materials, and labor shall be provided by the contractor.

C. The Contractor shall record all tests and system calibrations, and a copy of these results shall be retained on site in the System Logbook.

3.13 DOCUMENTATION

A. On completion of the system the contractor shall provide the following documentation:

1. One set of system record drawings & wiring details in printed & CAD formats.
2. Two sets of System Operation, Installation & Maintenance manuals.
3. Complete listings of fitted devices, their programmed parameters, texts and assignments.
4. Documentation of all programmed cause & effects.
5. Documentation of actual field wiring topology.
6. Copy of the system programming on CD or USB memory sticks.
7. System logbook.

3.14 TRAINING

A. Training shall be provided as follows:

1. The contractor shall provide full training on system operation & user responsibilities to at least two persons nominated by the customer.

END OF SECTION 28.4611.25

SECTION 28.5500 RF SURVEY FOR EMERGENCY RESPONDER RADIO ANTENNA/ REPEATER BDA SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. The purpose of this specification is to establish the requirements and standards for initial survey for public safety radio signal strength per NFPA and IFC

B. Survey should be performed after the building is substantially completed, and prior to start of installation of electrical wiring.

C. Conduct a survey using a RF Spectrum Analyzer, a calibrated, system-compatible radio or another suitable instrument with traceable certificate of calibration to analyze the RF signal strength of Emergency Responder Radio Signal into the building and determine if amplification of the signal is required. Both inbound and outbound signal strength shall be determined, measured, calculated and documented as required by code.

1.2 SURVEY CRITERIA IF REQUIRED

A. The required Public Safety Radio Signal Level inside the Owner's facility must be determined per code, ordinance or AHJ

B. Survey shall be performed by an FCC licensed technician holding a current GROL license.

1.3 REGULATIONS

A. Codes, regulations and standards referenced in the Section are:

1. NFPA 1 – The National Fire Code (including Annex O from 2009)
2. NFPA 70 – The National Electrical Code
3. IFC 510- Emergency Responder Radio Coverage
4. NFPA 101, Life Safety Code, the Ohio Building Code, and Local Code and Building Authority requirements.
5. NFPA 72 National Fire Alarm Code
6. FCC 47 CFR Private Land Mobile Radio
7. 90.219 Services-Use of Signal Boosters
8. ICC International Fire Code, Code and Commentary
9. Local or State Promulgated Fire Code
10. ADA "Americans with Disabilities Act"
11. FCC's OET 65 Standards "Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields"

12. FCC Rules Part 22, Part 90 and Part 101
13. NFPA 1221 2016 Edition
14. International Building Code 2012 / 2015 / 2018
15. UL 2524

1.4 DEFINITIONS

A. Definitions:

1. Bi-Directional Amplifier BDA: Device used to amplify band-selective or multi-band RF signals in the uplink, to the base station and in the downlink from the base station to subscriber devices for enhanced signals and improved coverage.
2. Emergency Responder Radio Coverage System: A two-way radio communication system installed to assure the effective operation of radio communications systems for fire, emergency medical services, or law enforcement agencies within a building or structure. A system used by firefighters, police, and other emergency services personnel.
3. FCC: Federal Communications Commission
4. OET 65 Standards: FCC's Bulletin 65 provides Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.
5. Public Safety/First Responder: Public Safety or First Responder agencies that are charged with the responsibility of responding to emergency situations. These include, but are not limited to law enforcement departments, fire departments, and emergency medical companies.
6. RSSI: Received signal strength indicator RSSI is a measurement of the power present in a received radio signal.
7. BER: Bit Error Rate is the number of bit errors per unit time
8. GROL- FCC General Radio Operators License
9. ERRCES- Emergency Responder Radio Coverage Enhancement System
10. DAS-Distributed Antenna System

1.5 EXECUTION

A. Testing Procedures

1. Minimum Signal Strength: For testing system signal strength and quality, the testing shall be based on the. -95dBm nominal signal at 100%.
2. Spectrum Analyzer or Calibrated Handheld Radio shall be used as basis for signal measurements or other method as approved by AHJ.
3. Testing should be based on a minimum of 20 grid locations per floor OR maximum of 1600 SQ ft. areas if the floor exceeds 32,000 Sq. Ft. Also, testing should include all critical areas per NFPA. See 1.02 of this specification and NFPA 72 2013 or NFPA 1221 2016. OR per any method determined by the AHJ, local code or ordinance.
4. A minimum signal strength of -95 dBm shall be provided throughout the coverage

area for both uplink and downlink by the Local Fire Department.

a. RSSI measurement only

B. Submit testing data for each level of the building.

1. An RF measurement drawing of each floor of the building which indicates relative RF field strength for each frequency band of interest must be submitted to the AHJ.
2. The drawing should indicate clearly the areas that have passed or failed based on the above parameters.

END OF SECTION 28.5500

SECTION 31.1100 - CLEARING AND GRUBBING

PART 1 - GENERAL

1.01 SECTION DESCRIPTION

A. The Work of This Section Includes:

1. Clearing
2. Grubbing
3. Stripping and stockpiling topsoil
4. Debris disposal

B. Definitions:

1. Clearing is defined as the removal of trees, brush, down timber, rotten wood, rubbish, any other vegetation, and objectionable material at or above original ground elevation not designated to be saved. Clearing also includes removal of fences, walls, guard posts, guard rail, signs, rubble, and other obstructions interfering with the proposed work.

2. Grubbing is defined as the removal from below the surface of the natural ground of stumps, roots and stubs, brush, organic materials and debris.

1.02 JOB CONDITIONS

A. Contractor may clear all obstructions within the limit of disturbance of Owner's property as absolutely necessary to perform the construction work. Contractor shall not disturb portions of Owner's property beyond the limit of disturbance. Removal of trees shall be as shown on the Drawings and coordinated with the Resident Project Representative.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Temporary Fencing:

1. Undamaged orange, open mesh plastic construction fencing, 4' high, or other acceptable, highly visible, weather resistant, easily maintained fencing that provides a substantial barrier.

2. Soil-set fence posts, studded "T" type, 6' high.

B. Tree Wound Dressing:

1. Damage shall be addressed according to National Arborist Association/Tree Care Industry Association standards.

PART 3 - EXECUTION

3.01 PREPARATION

A. Notify Resident Project Representative at least 48 hours prior to beginning any clearing work.

B. Protect benchmarks, utilities, existing trees, shrubs and other landscape features designated for preservation with temporary fencing or barricades satisfactory to the Resident Project Representative. No material shall be stored or construction operation carried on within four (4) feet of any tree to be saved or within the tree protection fence.

3.02 UTILITY RELOCATIONS

A. Inform all companies, individuals and others owning or controlling facilities or structures within the limits of the work which have to be relocated, adjusted or reconstructed in sufficient time for the utility to organize and perform such work in conjunction with or in advance of Contractor's operations.

B. Comply with the provisions of PA Act 287 (1974) and as last amended.

3.03 CLEARING

A. Confine clearing as required to within the limits of disturbance, including within the public rights-of-way, easements, and Owner's property. Attention is called to Paragraph 1.02 of this Section.

B. Fell trees in a manner that will avoid damage to trees, shrubs, and other installations which are to be retained.

C. Grind all stumps.

END OF SECTION

SECTION 31.2000 – EARTHWORK

PART 1 - GENERAL

1.01 SECTION DESCRIPTION:

A. Site grading, removal of topsoil and subsoil, excavation and backfill.

B. Preparing of subgrade for site structures, walks and pavements.

1.02 QUALITY ASSURANCE

A. Testing Agency

1. Any required compaction testing for this Project shall be performed by a qualified soils testing agency engaged and paid for by Contractor.

B. Reference Standards:

1. Pennsylvania Department of Transportation
Publication 408 Specifications

2. American Society for Testing and Materials (ASTM):

ASTM D422 Test Method for Particle-Size Analysis of Soils

ASTM D1557 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft.-lbf/ft^3)

ASTM D2922 Standard Test Method for Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth)

ASTM D4318 Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

C. Compaction Testing:

1. Conduct compaction tests at locations as directed by the Resident Project Representative during grading operations.

1.03 SUBMITTALS

A. Submit certified test reports on borrow material. Test reports shall include grain size distribution (ASTM D422), Atterberg limits (ASTM D4318) and moisture density relationship (ASTM D1557).

B. Submit certified compaction testing results from the soils testing agency for any required compaction testing.

1.04 JOB CONDITIONS

A. All earthwork shall be performed in accordance with conditions outlined in Section 01 57 13, Soil Erosion and Sediment Control, and the Drawings.

B. Site disturbance and earth moving shall proceed in accordance with the sequence shown on the Drawings.

C. Contractor may conduct earthwork activities within the limits of disturbance as shown on the Drawings.

D. Prior to earth moving activities, all topsoil shall be stripped and stockpiled in accordance with Section 31 11 00 and the Drawings.

E. Classification of Excavation:

1. See Soil Management Plan report and drawing and Drawings for information on limits.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. Topsoil, general site restoration: Excavated or imported friable loam that is reasonably free of subsoil, clay lumps, brush, roots, weeds, other objectionable vegetation, stones or other foreign material. Topsoil shall be free of weeds, weed seeds, foreign grass, and toxic substances, such as pesticides, that are harmful to plant growth.

B. Subbase Material: Washed, evenly graded mixture of crushed stone with 100 percent passing a 2 inch sieve and from 10 to 30 percent passing a No. 16 sieve designated PennDOT No. 2A Modified coarse aggregate, Table C, Section 703.2, Publication 408 Specifications.

C. Drainage Fill: Washed, evenly graded mixture of crushed stone with 100 percent passing a 2 inch sieve and from 10 to 30 percent passing a No. 16 sieve. PennDOT No. 2A Modified coarse aggregate, Table C, Section 703.2, Publication 408 Specifications.

D. Fill Materials: Satisfactory on-site soil materials comprised of less than 40% by weight larger than 3/4 inches in diameter, free of particles larger than 4 inches, and free of debris, slag, waste, frozen material, excessive moisture, organics, or other deleterious material.

PART 3 - EXECUTION

3.01 STORAGE OF EXCAVATED MATERIALS

A. Stockpile excavated materials acceptable for backfill and fill. Place, grade and shape stockpiles for proper drainage and protect as necessary.

1. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.

2. Dispose of excess excavated soil material and materials not acceptable for use as backfill or fill.

3.02 EXCAVATION FOR SITE STRUCTURES

A. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot, and extending a sufficient distance from site structures to permit placing and removal of concrete formwork, installation of services, and other construction and for inspection. In the event that fill deposits or other unsuitable bearing materials are encountered at the given elevations, they shall be over-excavated and replaced with structural backfill as specified hereinafter.

1. Excavations for site structures: Do not disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.

B. In the event bedrock is encountered at the footing subgrade elevation, it shall be overexcavated to a level 12 inches below the plan site structure subgrade elevation and 12 inches beyond the perimeter of the site structure on all sides. Bedrock encountered within four (4) inches of the base of the site structure shall be removed to at least six (6) inches below the base elevation for the site structure. The overexcavations specified above shall be restored to the subgrade elevation with PA No. 2A or 2RC processed aggregate which is placed and compacted as specified hereinafter.

C. Any soft, weak and/or unstable soil encountered at the footing subgrade elevation shall be overexcavated to satisfactory bearing material. Subsequently, the overexcavation shall be backfilled to the plan subgrade elevation with either lean concrete or PA No. 2A or 2RC processed aggregate.

3.03 EXCAVATION FOR PAVEMENTS

A. Cut surface under pavements to comply with cross-sections, elevations and grades as indicated.

3.04 COLD WEATHER PROTECTION

A. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

3.05 BACKFILL AND FILL

A. General: Place soil material in layers to required subgrade elevations, for each area classification listed below, using materials specified in Part 2 of this Section.

1. Under grassed area, use satisfactory excavated or borrow material.

2. Under walks and pavements, use subbase material, designated as PennDOT No. 2A Modified coarse aggregate, except for utility trench restoration in paved areas, in which PennDOT No. 2RC coarse aggregate will be used.

3. For utility and pipe trenches see Section 31 23 33.

B. Backfill site structure excavation as promptly as work permits, but not until completion of the following:

1. Acceptance of construction below finish grade including, where applicable, dampproofing, water-proofing and perimeter insulation.

2. Removal of concrete formwork.

3. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structure and remove in manner to prevent settlement of the structure, or leave in place if required.

4. Removal of trash and debris from excavation.

5. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

3.06 PLACEMENT AND COMPACTION

A. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, foundations, pavement sections, topsoil and organic and deleterious materials from ground surface prior to placement of fills (See Section 31 11 00). Plow, strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.

1. When existing ground surface has a density less than that specified under 3.06.E. for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.

2. After stripping and rough excavation grading, carefully inspect areas to provide support for the structural fill and pavement for soft surficial soils and proofroll with a fully loaded triaxle dump truck or similar approved equipment. Proofrolling shall be performed under the observation of the soils testing agency and Resident Project Representative. The proofroller shall make at least eight passes over each location, with the last two passes perpendicular to the first two. Any areas which wave, rut or deflect excessively and continue to do so after several passes of the proofroller shall be undercut to stable soils or as directed by the Owner's geotechnical engineer. The undercut areas shall be backfilled in thin lifts with suitable compacted refill materials.

3. The stripping and proofrolling operations shall be delayed in areas where the construction will not proceed immediately to a finished surface so that the exposed subgrade will not deteriorate under the effects of weather and construction traffic.

B. Place backfill and fill materials in layers not more than 8 inches in loose thickness for material compacted by heavy compaction equipment, and not more than 6 inches in loose thickness for material compacted by hand-operated tampers.

C. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen or contain frost or ice.

D. Place backfill and fill materials evenly adjacent to structures to required elevations. Prevent wedging action of backfill against structures by carrying material uniformly around structure, piping or conduit to approximately same elevation in each lift.

E. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts as directed by Resident Project Representative if soil density tests indicate inadequate compaction.

1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum dry density, in accordance with ASTM D1557 (Modified Proctor):

a. Under pavements, compact top 12 inches of subgrade and each layer of backfill or fill material at 95% (Modified Effort) of the maximum density, at or near the optimum moisture content.

b. Non-structural areas which lie within five (5) feet of building, pavement and structural areas at 93% (Modified Effort) of the maximum density at or near the optimum moisture content.

c. Under lawn or unpaved areas, compact top 6 inches of subgrade and each layer of backfill or fill material at 90% (Modified Effort) of the maximum density at or near the optimum moisture content.

d. Under walkways, compact top 6 inches of subgrade and each layer of backfill or fill material at 93% (Modified Effort) of the maximum density, at or near the optimum moisture content.

2. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.

a. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

b. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

3.07 GRADING

A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.

B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent low points as shown on the Drawings. Finish surfaces free from irregular surface changes and as follows:

1. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevations.

2. Walks: Shape surface of areas under walks to line, grade and cross section, with finish surface not more than 0.10 foot above or below required subgrade elevation.

3. Pavements: Shape surface of areas under pavement to line, grade and cross section, with finish surface not more than 1/2 inch above or below required subgrade elevation.

C. Grading Surface of Fill under Site Structure Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of ½ inch when tested with a 10-foot straightedge.

D. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

3.08 SITE STRUCTURE SLAB DRAINAGE COURSE

A. General: Drainage course consists of placement of drainage fill material, in layers of indicated thickness over subgrade surface to support concrete site structure slabs.

B. Placing: Place drainage fill material on prepared subgrade in layers of uniform thickness, conforming to indicated thickness.

1. When compacted drainage course is indicated to be 6 inches thick or less, place

material in a single layer. When indicated to be more than 6 inches thick, place material in equal layers, except no single layer more than 6 inches or less than 3 inches in thickness when compacted.

3.09 EROSION CONTROL

A. Provide erosion control methods in accordance with Section 01 57 13 and the Drawings.

3.10 MAINTENANCE

A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

B. Repair and re-establish grades in settled, eroded and rutted areas to specified tolerances.

C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape and compact to required density prior to further construction.

D. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact and replace surface treatment. Restore appearance, quality and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.11 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Removal from Owner's Property: Remove waste materials, including unacceptable excavated material, trash and debris, and properly dispose of it off Owner's property.

END OF SECTION

SECTION 31.2316.13 - TRENCHING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Backfilling and compacting for utilities outside the building to utility main connections.

1.2 RELATED REQUIREMENTS

A. Section 312200 - Grading: Site grading.

B. Section 312316 - Excavation: Building and foundation excavating.

C. Section 312316.26 - Rock Removal: Removal of rock during excavating.

D. Section 312323 - Fill: Backfilling at building and foundations.

E. Section 334600 - Subdrainage: Filter aggregate and filter fabric for foundation drainage systems.

1.3 DEFINITIONS

1.4 REFERENCES

A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials; 2010.

B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012.

C. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)); 2012.

1.5 SUBMITTALS

A. Compaction Density Test Reports.

1.6 DELIVERY, STORAGE, AND HANDLING

PART 2 PRODUCTS

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that survey bench marks and intended elevations for the work are as indicated.

3.2 PREPARATION

3.3 TRENCHING

A. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

B. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.

C. Do not interfere with 45 degree bearing splay of foundations.

D. Cut trenches wide enough to allow inspection of installed utilities.

E. Hand trim excavations. Remove loose matter.

F. Remove excavated material that is unsuitable for re-use from site.

G. Remove excess excavated material from site.

3.4 PREPARATION FOR UTILITY PLACEMENT

A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.5 BACKFILLING

A. Backfill to contours and elevations indicated using unfrozen materials.

B. Fill up to subgrade elevations unless otherwise indicated.

C. Employ a placement method that does not disturb or damage other work.

D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

E. Maintain optimum moisture content of fill materials to attain required compaction density.

F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.

G. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches compacted depth.

H. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

I. Correct areas that are over-excavated.

1. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.

J. Compaction Density Unless Otherwise Specified or Indicated:

1. Under paving, slabs-on-grade, and similar construction: 97 percent of maximum dry density.
2. At other locations: 95 percent of maximum dry density.

K. Reshape and re-compact fills subjected to vehicular traffic.

3.6 BEDDING AND FILL AT SPECIFIC LOCATIONS

A. Use general fill unless otherwise specified or indicated.

B. Utility Piping, Conduits, and Duct Bank:

3.7 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for general requirements for field inspection and testing.

B. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D698 ("standard Proctor"), ASTM D1557 ("modified Proctor"), or AASHTO T 180.

C. If tests indicate work does not meet specified requirements, remove work, replace and retest.

END OF SECTION 312316.13

SECTION 31.2316.26 - ROCK REMOVAL

PART 1 GENERAL

1.01 SECTION DESCRIPTION:

A. The Work of This Section Includes:

1. Removal of identified and discovered rock during excavation.
2. Mechanical methods and explosive methods to assist rock removal.

1.02 QUALITY ASSURANCE

A. Reference Standards:

1. National Fire Protection Association (NFPA): NFPA 495 - Code for Manufacture, Transportation, Storage, and Use of Explosive Materials

B. Seismic Monitoring Firm: Company specializing in seismic surveys with five (5) years documented experience.

C. Explosives Firm: Company specializing in explosives for disintegration of rock, with five (5) years documented experience. All blasting shall be performed by or under the supervision of an individual with a valid Commonwealth of Pennsylvania blaster's license.

1.03 DEFINITIONS

A. Rock: Solid mineral material of a size that cannot be removed with a "Trac-Hoe" style machine with a minimum weight of 70,000 pounds (without use of drilling and wedging, blasting, and/or mechanical surface impact equipment).

1.04 REGULATORY REQUIREMENTS

A. Conform to "Regulations for the Storage, Handling and Use of Explosives" of the Pennsylvania Department of Labor and Industry; and to NFPA 495 for handling explosive materials.

B. Obtain all required permits from various local and State agencies.

C. Comply with all permit conditions including timely notifications to all required agencies/officials.

1.05 PROJECT CONDITIONS

A. Advise owners of nearby buildings or structures in writing, prior to performing any blasting operations to explain planned blasting operations, and pre-blast survey.

B. Conduct a pre-blasting survey and document conditions of nearby buildings, structures and wells, prior to blasting, in order to assess, record and photograph existing structural conditions of buildings (interior & exterior) identifying existing irregularities and to monitor water supply wells for water level along with samples for total coliform organisms and turbidity. Nearby buildings, structures and wells are considered to be those within 500 feet of any trench or site excavation requiring rock removal. Monitoring and sample results from the water supply wells and structural observations of buildings shall be immediately forwarded to Owner and Engineer.

C. Store all explosives in a secure and safe manner in strict conformance to all State and local municipal regulations; storage locations shall be clearly marked "DANGEROUS EXPLOSIVES", and shall be in care of a competent watchman at all times. In no case shall caps or other detonators be stored or transported with explosives. Explosives shall be kept on the site only in such quantities as anticipated to be required for the Project and only during the time when being used.

D. Rock excavation within ten (10) feet of underground utilities or structures shall be done by hand or with light charges of explosives with exercise of utmost care to avoid disturbance. Owner reserves the right to direct that rock be removed by methods other than blasting in such cases.

E. No blasting shall be performed within 50 feet of the utility lines being constructed as part of the Work nor for a period of at least 48 hours after concrete has been placed within 100 feet of the blasting operation.

F. Special care shall be exercised in areas where high tension power lines are located.

G. Paving shall be pre-cut before blasting within roads to prevent paving from heaving beyond normal trench width.

1.06 SCHEDULING

A. Schedule Work under the provisions of Section 01 33 00 concerning the submittal for a Construction Progress Schedule.

B. Schedule Work to avoid disruption to occupied buildings nearby.

PART 2 PRODUCTS

2.01 MATERIALS

A. Explosives: Type recommended by explosives firm.

B. Delay Device: Type recommended by explosives firm.

C. Blast Mat Materials: Type recommended by explosives firm.

D. Mechanical Disintegration Compound: Grout mix of materials that expand on curing.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify site conditions and note subsurface irregularities affecting work of this section.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

3.03 ROCK REMOVAL BY A MECHANICAL METHOD

A. Excavate and remove rock by the mechanical method.

B. Drill holes and utilize expansive tools, wedges, and/or mechanical disintegration compound to fracture rock.

C. Cut away rock at bottom of excavation to form level bearing.

D. Remove shaled layers to provide sound and unshattered base for footings and foundations.

E. In utility trenches, excavate to 6 inches below invert elevation of pipe and 12-16 inches wider than pipe outside diameter (minimum 6 inches on each side).

F. Shattered or fractured rock may be allowed by Owner as trench backfill where native backfill material is permitted provided that the size requirement in Section 31 23 33 and Drawings is achieved. Otherwise, excavated rock must be removed from site.

G. Correct unrequired rock removal in accordance with the requirements of Section 31 23 33.

3.04 ROCK REMOVAL BY EXPLOSIVE METHODS

A. If rock is uncovered requiring the explosives method for rock disintegration, notify Owner and Resident Project Representative and execute as follows.

B. Provide seismographic monitoring during progress of blasting operations. Keep and submit to Owner upon request an accurate record of each blast which includes the general location of the blast, the depth and number of drill holes, the kind and quantity of explosive used, particle velocity and displacement, decibels, and other data as required for a complete record.

C. Drill blasting holes, prepare blasting charges and cover area with blasting mats.

D. Perform blasting to disintegrate rock and remove from excavation. Use such quantities and strengths of explosives and perform blasting in such manner as will break the rock approximately to the desired lines and grades, yet will leave rock not requiring excavation in an unshattered condition.

E. Remove rock at excavation bottom to form level bearing.

F. Remove shaled layers to provide a sound and unshattered base for footings, foundations, and utility construction.

G. In utility trenches, excavate to 6 inches below invert elevation of pipe and 12-16 inches wider than pipe outer diameter (minimum 6 inches on each side).

H. Shattered or fractured rock may be allowed by Owner as trench backfill where native backfill material is permitted provided that the size requirement is in Section 31 23 33 and Dwais achieved. Otherwise, excavated rock must be removed from site.

I. Correct unrequired rock removal in accordance with the requirements of Section 31 23 33.

J. Repair any damage from blasting operations including damaged paving beyond trench width.

3.05 FIELD QUALITY CONTROL

A. Contractor shall provide for visual inspection by Resident Project Representative all trench bottoms, foundation bearing surfaces and cavities formed by removed rock prior to further construction.

END OF SECTION

SECTION 31.2333 - EXCAVATION, BACKFILL AND COMPACTION

PART 1 - GENERAL

1.01 SECTION DESCRIPTION

A. The Work of this Section Includes:

1. Excavation, backfill and compaction associated with utility construction, including such related features as protection of adjacent utilities and structures, maintenance and protection of traffic, cutting paved surfaces, support of excavation, control of excavated materials, dewatering, pipe bedding, disposal of excavated materials, rough grading and restoration.

2. Excavation, backfill and compaction associated with construction or installation of structures including such related features as protection of adjacent utilities and structures, support of excavation, control of excavated materials, dewatering, structure bedding, disposal of excavated materials, rough grading and restoration.

1.02 QUALITY ASSURANCE

A. Testing Agent:

1. Compaction testing for this Work shall be performed by Contractor at the discretion of the Resident Project Representative except as required by a PennDOT Highway Occupancy Permit. Where compaction testing is required by permit, such compaction testing shall be performed by an independent soils testing agent engaged and paid for by Contractor.

2. Contractor shall pay the cost of one series of tests on the area being evaluated. Contractor shall also pay the cost for additional testing as required in the event of improper performance of the Work.

B. Reference Standards:

1. Pennsylvania Department of Transportation:

Regulations Governing Occupancy of Highways by Utilities (67 PA Code, Chapter 459)
Publication 408 Specifications
Pennsylvania Test Method, PTM 106
Pennsylvania Test Method, PTM 402
Publication 203, Work Zone Traffic Control

2. American Society for Testing and Materials (ASTM):

ASTM D1557	Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft.- lbf/ft^3)
ASTM D2922	Standard Test Method for Density of Soil and Soil - Aggregate in Place by Nuclear Methods (Shallow Depth)

C. Compaction Testing:

1. Conduct compaction tests at locations during backfilling operations at the discretion of the Resident Project Representative and as required by a PennDOT Highway Occupancy Permit.

1.03 SUBMITTALS

A. Certificates:

1. Submit certification attesting that the composition analysis of pipe embedment and select material stone backfill materials meet specification requirements in accordance with Section 01 33 00.

2. Submit certified compaction testing results from the soils testing agency for any required compaction testing in accordance with Section 01 33 00.

1.04 JOB CONDITIONS

A. Classification of Excavation:

1. See Soil Management Plan report and drawing and Drawings for information on limits.

B. Rock Removal:

1. See Section 31 23 16.26 relative to removal of rock.

C. Compaction of Backfill:

1. Excavations shall be backfilled in lifts not exceeding compacted thicknesses noted in Paragraph 3.11C. Each lift shall be individually compacted.

2. The following percentages of maximum dry density shall be achieved:

	Modified Effort ASTM D1557
• Building Foundation and Structural Slab-on-Grade	95%
• Exterior Side of Structure Walls	95% to point 5' from building wall, then 90%
• Trench Backfill under Pavement (not including base course materials)	95%
• Trench Backfill within Unpaved Areas	90%

3. Contractor shall maintain moisture content of backfill materials at or near the optimum moisture content to attain the required compaction density.

D. Control of Traffic:

1. Employ traffic control measures in accordance with Pennsylvania Department of Transportation Publication 213 Temporary Traffic Control Guidelines and as shown on Drawings.

E. Protection of Existing Utilities and Structures:

1. Take all precautions and utilize all facilities required to protect existing utilities and structures. In compliance with Pennsylvania Act 287 (1974) and as last amended, advise

each Utility at least three (3) working days in advance of intent to excavate, do demolition work or use explosives and give the location of the job site. Request cooperative steps of the Utility and suggestions for procedures to avoid damage to its lines.

2. Advise each person in physical control of powered equipment or explosives used in excavation or demolition work of the type and location of utility lines at the job site, the Utility assistance to expect, and procedures to follow to prevent damage.

3. Immediately report to the Utility, Owner, Engineer, and Resident Project Representative any break, leak or other damage to the lines or protective coatings made or discovered during the work and immediately alert the occupants of premises of any emergency created or discovered.

4. Allow free access to Utility personnel at all times for purposes of maintenance, repair and inspection.

F. Protection of Trees and Shrubs

1. See Section 31 11 00.

2. **Any trees and/or shrubs to be protected which are damaged or destroyed during construction shall be replaced in kind as required by Owner at no cost to Owner.**

PART 2 - PRODUCTS

2.01 PIPE BEDDING AND EMBEDMENT MATERIAL

A. Bedding to Springline of Pipe: AASHTO No. 57 coarse aggregate Table C, Section 703.2, Publication 408 Specifications. Do not use slag or cinders.

B. Springline of Pipe to 12" over Pipe: PennDOT No. 2A coarse aggregate under paved areas and AASHTO #57 for grassed areas, Table C, Section 703.2, Publication 408 Specifications. Do not use slag or cinders.

2.02 BACKFILL MATERIAL

A. All Paved Surfaces:

1. From 12" over top of pipe: Minimum 6” PennDOT No. 2A course aggregate compacted in maximum 12” lifts to bottom of asphalt base course

B. Grassed Areas:

1. From 12" over top of pipe: Select backfill in maximum 12” lifts to bottom of 6” topsoil

PART 3 - EXECUTION

3.01 EXAMINATION & PREPARATION

A. Identify required lines, levels, contours and datum.

B. Notify Resident Project Representative and Engineer of unexpected subsurface conditions and discontinue work in area until notified to resume work.

C. Maintain and protect existing utilities identified by utility users within the Work area (see

paragraph 1.04E).

D. Verify bracing to support surcharge forces imposed by backfilling operations.

3.02 PROTECTION OF ADJACENT WORK

A. Support adjacent structures which may be damaged by excavation work, including asphalt, utilities and pipe chases.

B. Grade excavation top perimeter to prevent surface water runoff into excavation or to adjacent properties.

3.03 MAINTENANCE AND PROTECTION OF TRAFFIC

A. Coordinate the work to ensure the least inconvenience to traffic and maintain traffic in one or more unobstructed lanes unless closing the roadway is authorized.

B. Maintain access to all streets and private drives.

C. Provide and maintain signs, flashing warning lights, barricades, markers, and other protective devices as required to conform with construction operations, protect public safety, and to keep traffic flowing with minimum restrictions.

D. Comply with State and local Municipal codes, permits and regulations.

3.04 CUTTING PAVED SURFACES

A. Where installation of pipelines, structures, and appurtenances necessitate breaking a paved surface, make cuts in a neat uniform fashion forming straight lines parallel with the edge of the excavation. Cut offsets at right angles to the edge of the excavation.

B. Protect edges of cut pavement during excavation to prevent raveling or breaking; square edges prior to pavement replacement.

3.05 EXCAVATION

A. Depth of Excavation:

1. Gravity Pipelines:

a. Excavate trenches to the depth and grade shown on the Drawings for the invert of the pipe plus that excavation necessary for placement of pipe bedding material.

b. Excavation shall provide a straight uniform grade, plus that excavation necessary for placement of pipe bedding material.

2. Structures:

a. Excavate to the minimum depth necessary to install footings, concrete slab or precast base plus that excavation necessary to place the required base material as shown on the Drawings.

3. Where unsuitable bearing material including shattered rock due to drilling or blasting operations is encountered in the bottom of the excavation, continue excavation until the unsuitable material is removed, solid bearing is obtained or can be established, or concrete/concrete cradle can be placed. If no concrete/concrete cradle is to be installed,

refill the excavation to required grade with pipe bedding/embedment or slab/base material as appropriate.

4. Where Contractor, by error or intent, excavates beyond the minimum required depth, backfill the excavation to the required depth with pipe bedding/embedment or slab/base material as appropriate at no cost to Owner.

B. Width of Excavation:

1. Gravity Pipelines:

a. Excavate trenches, including laterals, to a width necessary for placement and jointing of the pipe, and for placing and compacting pipe embedment under, around and over the pipe, but not less than 6" or more than 12" on each side of the pipe.

b. Shape trench walls completely vertical from trench bottom to at least two (2) feet above the top of the pipe.

c. For pressure pipeline fittings, excavate trenches to a width that will permit placement of concrete thrust blocks. Provide earth surfaces for thrust blocks that are perpendicular to the direction of thrust and are free of loose or soft material.

2. Structures:

a. Excavate to the minimum distance necessary for placement/installation of the footings, concrete slab, walls or prefabricated structures and to permit proper backfill procedures to be performed.

C. Length of Open Trench:

1. Limit advanced clearing and grubbing operations to a distance equal to two times the length of pipe installation that can be completed in one day.

2. Work crews and equipment for trenching, placement of pipe, plug construction, and backfilling shall be self contained and separate from work crews for clearing-grubbing and site restoration-stabilization operations.

3. Limit daily trench excavation to the length of pipe placement, plug installation and backfilling that can be completed the same day.

4. On the day following pipe placement and trench backfilling, grade the disturbed area to final contours and stabilize immediately in accordance with the seeding & mulching schedule.

3.06 SUPPORT OF EXCAVATION

A. Support excavations with sheeting, shoring, and bracing or in the case of pipeline construction, a "trench box" as required to comply with Federal and State laws and codes.

B. Install adequate excavation supports to prevent ground movement or settlement to adjacent structures, pipelines or utilities. Damage due to settlement because of failure to provide support or through negligence or fault of Contractor in any other manner, shall be repaired at Contractor's expense.

C. Withdraw shoring, bracing, and sheeting as backfilling proceeds unless otherwise directed by the

Resident Project Representative.

D. The neglect, failure or refusal of the Resident Project Representative to order the use of bracing or sheeting, or a better quality, grade, or section, or larger sizes of steel or timber, or to order sheeting, bracing, struts, or shoring to be left in place, or the giving or failure to give orders or directions as to the manner or methods of placing or driving sheetings, bracing, jacks, wales, stringers, etc., shall not in any way or to any extent relieve Contractor of any responsibility concerning the condition of excavation or of any of his obligations under the Contract, nor shall any delay, whether caused by any action or want of action on the part of Contractor, or by any act of Owner and Engineer or their agents, or employees, resulting in the keeping of an excavation open longer than would otherwise have been necessary, relieve Contractor from the necessity of properly and adequately protecting the excavation from caving or slipping, nor from any of their obligations under the Contract relating to injury of persons or property, nor entitle them to any claim for extra compensation.

3.07 CONTROL OF EXCAVATED MATERIAL

A. Keep the ground surface, within a minimum of 2' of the sides of the excavation, free of excavated material.

B. Provide temporary barricades to prevent excavated material from encroaching on private property, walks, gutters, and storm drains.

C. Maintain accessibility to all fire hydrants, valve pit covers, valve boxes, curb boxes, fire and police call boxes, and other utility controls at all times. Keep gutters clear or provide other satisfactory facilities for street drainage. Do not obstruct natural water courses. Where necessary, provide temporary channels to allow the flow of water either along or across the site of the work.

D. In areas where excavations parallel or cross streams, ensure that no material slides, is washed, or dumped into the stream course. Remove diversion structures and/or cofferdams immediately upon completion of construction within the stream.

3.08 DEWATERING

A. Keep excavations dry and free of water. Dispose of precipitation and subsurface water clear of the work.

B. Maintain pipe trenches dry until pipe has been jointed, inspected, and backfilled, and concrete work has been completed. Prevent trench water from entering pipelines under construction.

C. Intercept and divert surface drainage away from excavations. Design surface drainage systems so that they do not cause erosion on or off the site, or cause unwanted flow of water.

D. Comply with Federal and State requirements for dewatering to any watercourse, prevention of stream degradation, and erosion and sediment control.

3.09 PIPE LAYING

A. Provide required pipe bedding placed in accordance with the Drawings and Specifications (Paragraph 2.01). A minimum bedding depth of 6" shall be provided when bedding is required.

B. Shape recesses for the joints or bell of the pipe by hand. Assure that the pipe is supported on the lower quadrant for the entire length of the barrel.

C. Lay pipe as specified in the appropriate Section of these Specifications for pipeline construction.

3.10 STRUCTURE PLACEMENT/INSTALLATION

A. Provide required base material in accordance with the Drawings and Specifications (Paragraph 2.02).

3.11 BACKFILLING EXCAVATIONS

A. Pipeline Trench:

1. After pipe installation and inspection, provide material to complete the pipe embedment in accordance with the Drawings and Specifications.

2. Unless otherwise shown on the Drawings, the bedding or embedment requirements using the material noted in Paragraph 2.01 shall apply.

3. The material shall be hand-placed and carefully compacted with hand-operated mechanical tampers in layers of suitable thickness to provide specified compaction around and under the haunches of the pipe. Backfill and compact the remainder of the trench with specified backfill material in accordance with the Drawings and any relevant permit conditions. Employ a placement method so not to disturb or damage the utility line in the trench. Use of a Hydra-hammer or jumping-jack type compaction device is not permitted within two (2) feet of the utility line. A vibratory plate type compaction device and/or trench roller is acceptable. Vibratory compaction equipment or trench rollers shall be used for the lifts of coarse aggregate backfill within existing streets and paved areas. Any settlement which occurs because of consolidation of the backfill during the construction period or during the required maintenance period shall be corrected by Contractor.

B. Structure Excavation:

1. After structure installation and inspection, backfill the excavation with specified backfill material in accordance with the Drawings. Employ a placement method so not to disturb or damage foundation perimeter drainage, foundation damp proofing or water proofing and protective cover or utility lines. Backfill against supported foundation walls; backfill simultaneously on each side of unsupported foundation walls. Pipelines entering the structure must be provided with the specified bedding material hand placed and carefully compacted with hand-operated mechanical tampers in layers of suitable thickness to provide specified compaction around and under the haunches of the pipe. Use of a Hydra-hammer or jumping-jack type compaction device is not permitted within two (2) feet of a pipeline. A vibratory plate type compaction device and/or trench roller is acceptable and shall be used for the lifts of coarse aggregate backfill within existing paved areas. Any settlement which occurs because of consolidation of the backfill during the construction period or during the required maintenance period shall be corrected by Contractor.

C. Lift Thickness Limitations:

1. Lift thicknesses shall be limited to six (6) inches for pipe embedment and twelve (12) inches maximum for pipeline trenches and for structure excavations. In no case shall maximum lift thickness placed exceed the maximum limits specified by the manufacturer's recommendations for the compaction equipment to be utilized. Compaction equipment shall not be used over the pipe until sufficient backfill has been placed to ensure that such equipment will not damage or disturb the pipe.

D. Unsuitable Backfill Material and/or Compaction:

1. Where the Resident Project Representative deems backfill material to be unsuitable and rejects all or part thereof due to conditions prevailing at the time of construction, remove the unsuitable material and replace with suitable backfill material.

2. If, during progress of the Work, tests indicate that compacted materials do not meet specified requirements, remove defective material, replace and retest at no cost to Owner, as directed by the Resident Project Representative.

3.12 DISPOSAL OF EXCAVATED MATERIAL

A. Excavated material remaining after completion of backfilling shall remain the property of Contractor, removed from the construction area, and disposed of legally. Contractor shall either allow saturated soils to sufficiently dry prior to any hauling off-site or else use a sealed, watertight truck.

3.13 ROUGH AND FINE GRADING

A. Grade areas disturbed by construction to a uniform finish. Form the bases for terraces, banks, lawns and paved areas.

B. Grade areas to be paved to depths required for placing subbase and paving materials. Top surface of exposed subgrade to be plus or minus one inch.

C. Grade areas to be topsoiled and seeded to 6" below indicated finish contours.

D. Slope grade away from structures at a minimum 2 inches in 10 feet unless otherwise noted on Drawings.

3.14 RESTORATION OF UNPAVED SURFACES

A. Restore unpaved surfaces disturbed by construction to equal the surface condition prior to construction.

B. Restore grassed areas in accordance with Section 32 92 00, Finish Grading, Seeding and Sodding.

3.15 RESTORATION OF PAVED SURFACES

A. See Section 32 12 00.

END OF SECTION

SECTION 32.0116.71 - MILLING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Milling of Asphalt Paving

1.02 DESCRIPTION OF WORK

A. This work is the milling of an existing asphalt pavement surface, with specified equipment, to the specified depth.

1.03 QUALITY ASSURANCE

A. Reference Standards:

1. Pennsylvania Department of Transportation: Publication 408 Specifications

B. Perform Work in accordance with the latest edition of PennDOT Publication 408.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 EQUIPMENT

A. Use a milling machine designed and built for this type and width of work. Provide a machine with an effective automatic grade and slope control system and having the capacity to notch and taper mill and mill concrete patches.

3.02 MILLING OPERATION

A. Mill so the finished surface is free from gouges, grooves, and ridges and is in accordance with the specified surface tolerance requirements, or as directed.

B. Pick up and move milled material, as specified, immediately after the milling operations.

C. Use care to remove the existing asphalt material around all utility facilities within the work areas.

D. Repair or replace, to the satisfaction of the utility owner, utility facilities which are damaged by the milling operation.

E. Control the rate of milling to avoid tearing, resulting in chunky and non-uniformly milled material.

F. Separate oversize and chunky milled material as directed.

G. **Apply water for dust control during milling operations and keep milled pavement surface free of all loose materials and dust.**

H. Do not allow traffic to drive on any milled surface for more than 6 calendar days. Install the overlay asphalt wearing course within 7 calendar days from the start of the milling operation.

3.03 DISPOSITION OF MILLED MATERIAL

A. Contractor shall satisfactorily dispose of the milled material.

END OF SECTION

SECTION 32.0519.13 - GEOTEXTILE

PART 1 - GENERAL

1.01 SECTION DESCRIPTION

A. This work consists of furnishing and placing a geotextile for use as a permeable separator to prevent inter-mixing of dissimilar material such as subgrades and surfaced or unsurfaced pavement materials. The geotextile shall be designed to allow passage of water while retaining in situ-soil. This specification does not address geotextiles used for reinforcement.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Fabric consisting of long chain polymeric filaments or yarns such as polyethylene, polyamide, polyvinylidene-chloride, polypropylene, or polyester formed into a stable network so that the filaments or yarns retain their relative position to each other. Use fabric structure as noted in PennDOT Pub 408, section 735, Table A. Slit film woven fabrics may only be used for Class 3 Geotextiles. Chemically- or thermally-bonded fabrics are not allowed for any class of geotextile. Use fabric inert to commonly encountered construction chemicals or substances.

PART 3 - EXECUTION

3.01 SHIPPING & STORAGE

A. The geotextile shall be kept dry and wrapped such that it is protected from the elements during shipping and storage. If stored outdoors, the geotextile shall be elevated and protected with a waterproof cover. The geotextile rolls shall be labeled in accordance with ASTM D 4873-88, “Standard Guide for Identification, Storage and Handling of Geotextiles.”

B. Protect geotextiles from temperatures greater than 140F, mud, dirt, dust and debris.

C. To the extent possible, shield the fabric from direct sunlight. At no time shall the geotextile be exposed to ultraviolet light for a period exceeding 14 days.

3.02 SITE PREPARATION

A. The installation area shall be prepared by clearing all debris or obstructions that may damage the geotextile.

3.03 GEOTEXTILE PLACEMENT

A. The geotextile shall be unrolled as smoothly as possible on the prepared subgrade and overlapped in the direction of the subbase placement. Where overlapping is necessary, geotextile shall overlap a minimum of 6” and be held in place with 6” staples.

B. Damaged geotextiles, as identified by the Engineer, shall be replaced immediately.

END OF SECTION

SECTION 32.1200 - ASPHALT PAVING

PART 1 GENERAL

1.01 SECTION DESCRIPTION

A. The Work of this Section Includes:

1. Asphalt paving of surfaces

1.02 SYSTEM DESCRIPTION

A. Paving: Designed for traffic anticipated on the asphalt surface

1.03 QUALITY ASSURANCE

A. Reference Standards:

1. Pennsylvania Department of Transportation:

a. Publication 408 Specifications
b. Publication 27 – Specification for Bituminous Mixtures (Bulletin 27)

B. Perform Work in accordance with the latest edition of PennDOT Publication 408.

C. Mixing Plant: Conform to PennDOT Bulletin 27, Chapter 1 Standards.

D. Conform to applicable Borough standards for paving work on public property.

1.04 SUBMITTALS

A. Certificates:

Submit fully signed PennDOT TR-448A certification, dated in the year material will be placed, from asphalt supplier attesting that materials conform to the State Specifications in accordance with Section 01 33 00. Asphalt design mix shall be submitted to Engineer for approval prior to work commencement. No asphalt shall be placed until Engineer has approved the design mix.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Do not place asphalt when base surface temperature is less than 40 degrees F or base surface is wet or frozen.

1.06 JOB CONDITIONS

A. Restore existing paving outside the limits of the Work that is damaged by Contractor’s operations to its original condition at the expense of Contractor.

1.07 PRICE ADJUSTMENT

A. Asphalt price adjustments shall be made in accordance with PennDOT Publication 408, Section 110.04.

PART 2 PRODUCTS

2.01 PAVING MATERIALS

A. Base Course: PennDOT Superpave (Section 313 of Publication 408).

B. Wearing Course: PennDOT Superpave (Section 413 of Publication 408).

C. Tack Coat: TACK or NTT/CNTT (Section 460 of PennDOT Publication 408)

D. Joint Seal: Asphalt PG 64S-22 Sealant (Publication 408).

2.02 SUBBASE COURSE MATERIALS

A. Coarse Aggregate: PennDOT No. 2A (Section 703 of Publication 408).

2.03 PAINTING MATERIALS

A. Thermoplastic and Epoxy Pavement Markings: PennDOT Publication 408 & PennDOT Publication 35.

PART 3 EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Verify gradients and elevations of area to be paved.

B. Trim existing paving with minimum one (1) foot cutbacks to remove damaged areas. Cut straight joint lines and right angle offsets.

C. Remove any temporary paving material.

D. Proofroll subgrade (10 ton roller) and replace any soft or unsuitable material with coarse aggregate. Verify compacted subgrade is dry and ready to support paving and imposed loads.

E. Apply tack coat in accordance with PennDOT Publication 408 requirements prior to placing an overlay over existing paving or prior to placing a wearing coarse over a previous placed binder course.

F. Coat surfaces of any manhole or catch basin frames with oil to prevent bond with asphalt paving.

3.02 SUBBASE COURSE

A. Place PennDOT No. 2A coarse aggregate in continuous layers not exceeding 6 inches loose depth and compact (10 ton roller) to required contours and elevations.

3.03 PLACING TACK COAT

A. Per Section 460 of PennDOT Publication 408, except delete the third paragraph and Table B entirely and add the following:

Apply undiluted emulsifies asphalt tack coat, at a rate approved by the Resident Project Representative, to leave a uniform asphalt residue application rate as specified in Table A. Identify residual application rates on the Paving Operation QC Plan and review with the Representative at the Preplacement Meeting.

TABLE A
Uniform Asphalt Residue Application Rates by Surface Type

Surface Type	Uniform Asphalt Residue Application Rate (gallons per square yard)
New Asphalt Pavement	0.02 to 0.03
Existing Asphalt Pavement	0.03 to 0.05
Milled Pavement (Asphalt & Portland Cement Concrete)	0.05 to 0.07
Portland Cement Concrete Pavement	0.04 to 0.06

3.04 PLACING ASPHALT PAVEMENT

A. Place asphalt concrete base course on surface of compacted subbase course to compacted thickness (10 ton roller where possible; minimum 5 ton roller in trenches) as shown on Drawings.

B. Place binder and wearing courses to compacted thicknesses (10 ton roller except minimum 5 ton roller for binder course in trenches) as shown on the Drawings. Apply tack coat on completed binder course before placing wearing course should there be a delay between completion of binder course and placement of wearing course.

C. Place wearing course overlay to compacted thickness (10 ton roller) as and where shown on the Drawings.

D. Compact pavement by rolling to achieve even and smooth finish, without roller marks. Hand compact in areas inaccessible to rolling equipment.

E. Where proposed asphalt paving adjoins existing asphalt paving, seal the joint with asphalt material in accordance with PennDOT Publication 408 requirements.

F. Provide painted markings where shown on Drawings and in their former location which were covered or destroyed.

3.05 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.

B. Compacted Scheduled Thickness: Within 1/4 inch of design thickness.

C. Variation from True Elevation: Within 1/2 inch.

END OF SECTION

SECTION 32 12 23 - RESTORATION OF PAVED SURFACES

PART 1 - GENERAL

1.01 SECTION DESCRIPTION

A. The Work of This Section Includes:

1. Temporary Paving
2. Permanent Paving
3. Asphalt Overlay
4. Shoulder Restoration
5. Walkway Restoration
6. Driveways
7. Concrete Curb and Gutter Repairs
8. Stormwater Inlets and Piping
9. Street Signage

B. See Drawings for specific paving cross-sections.

1.02 QUALITY ASSURANCE

A. Referenced Standards:

1. Pennsylvania Department of Transportation:

a. Publication 408 - Specifications
b. Publication 27 - Specification for Bituminous Mixtures (Bulletin 27)
c. Publication 37 - Specification for Bituminous Materials (Bulletin 25)
d. Publication 213 – Temporary Traffic Control Guidelines

1.03 SUBMITTALS

A. Certificates:

1. Submit fully signed PennDOT TR-448A certification, dated in the year material will be placed, for each asphalt mix design in accordance with Section 01 33 00. Asphalt design mix shall be submitted to Engineer for approval prior to work commencement. No asphalt shall be placed until Engineer has approved the design mix.

1.04 JOB CONDITIONS

A. Control of Traffic:

1. Take measures to control traffic during repaving operations. Do not allow traffic on repaved areas until authorized by the Resident Project Representative.

2. Employ traffic control measures in accordance with the requirements of Section 01 55 26 including pertinent permits by PennDOT and/or local municipal agencies having jurisdiction.

B. Restore existing paving outside the limits of the Work that is damaged by Contractor's operations, to its original condition at the expense of Contractor.

PART 2 - PRODUCTS

2.01 CONCRETE

A. Concrete conforming to Section 704, PennDOT Publication 408 Specifications.

1. Requirements for State approved batch plants, design computations and plant inspection shall apply. The acceptability of concrete will be based on conformance with the Cement Concrete Criteria specified in Section 704 of PennDOT Publication 408 for the required Class of concrete and the results of the specified tests.

2. Submit fully signed PennDOT TR-4221 certification, dated in the year material will be placed, for each concrete mix design in accordance with Section 01 33 00. Concrete design mix shall be submitted to Engineer for approval prior to work commencement. No concrete shall be placed until Engineer has approved the design mix.

2.02 ASPHALT PAVING MATERIALS AND AGGREGATES

A. Base Course: PennDOT Superpave (Section 313 of Publication 408).

B. Wearing Course: PennDOT Superpave (Section 413 of Publication 408).

C. Asphalt Tack Coat: Per Section 460 of PennDOT Publication 408:

D. Emulsified Asphalt, Class E-8 (AASHTO CSS-1h or SS-1h)

E. Joint Seal: Asphalt PG 64S-22 Sealant (Section 469 Publication 408).

F. Coarse Aggregate: PennDOT No. 2A (Section 703 of Publication 408).

G. The acceptability of the material will be based on conformance with the Criteria specified in PennDOT Publication 408 for the required material.

H. Cut sheets/submittals for all paving materials and aggregates shall be submitted to Engineer for approval prior to work commencement. No paving materials and/or aggregates shall be placed until Engineer has approved the material.

PART 3 - EXECUTION

3.01 TEMPORARY PAVING

A. Provide temporary paving immediately upon completion of trench backfilling. Unpaved trenches shall not remain unpaved longer than ten (10) working days after backfilling.

B. Complete trench backfill with coarse aggregate in accordance with the Drawings and Publication 408 requirements.

C. Trim existing paving with minimum one (1) foot cutbacks to remove damaged areas. Cut straight joint lines and right angle offsets.

D. Place temporary paving material consisting of bituminous concrete base course to the required depth shown on the Drawings for the entire width of the trench. Place with a maximum lift thickness of three (3) inches and compact each lift individually using a trench roller (minimum 5 ton).

E. Continuously maintain temporary paving to the satisfaction of the Resident Project

Representative and the State and local municipal road departments having jurisdiction. Temporary paving on State roads must remain in place for a minimum of ninety (90) days.

3.02 PERMANENT PAVING

A. Place bituminous concrete base course on surface of compacted subbase course to compacted thickness (10 ton roller where possible; minimum 5 ton roller in trenches) as shown on Drawings.

B. Place base and wearing courses to compacted thicknesses (10 ton roller) as shown on the Drawings. Apply tack coat, per Section 32 12 00, on completed base course before placing wearing course should there be a delay between completion of base course and placement of wearing course.

C. Place wearing course overlay to compacted thickness (10 ton roller) as and where shown on the Drawings.

D. Compact pavement by rolling to achieve even and smooth finish, without roller marks. Hand compact in areas inaccessible to rolling equipment.

E. Where proposed asphalt paving adjoins existing asphalt paving, seal the joint with Asphalt PG 64-22 Sealant in accordance with Publication 408 Specifications.

F. Replace pavement markings in their former location which were covered or destroyed.

G. Maintain permanent paving to the satisfaction of the Resident Project Representative and the local municipal and State road departments having jurisdiction throughout the Contract maintenance period.

3.03 ASPHALT OVERLAY

A. Where indicated on the Drawings, or directed by the Resident Project Representative, place an asphalt overlay.

B. Construct in accordance with Publication 408 Specifications and Drawings.

C. Replace pavement markings in their former location which were covered or destroyed.

3.04 SHOULDER RESTORATION

A. Restore shoulders in accordance with the Drawings.

3.05 WALKWAY RESTORATION

A. Reconstruct portland cement sidewalks to 4" thickness of concrete placed on a 6" layer of 2A aggregate.

B. Reconstruct portland cement sidewalks to the first joint on either side of the damaged portion. Install expansion joint material.

3.06 DRIVEWAYS

A. Trim concrete and bituminous driveway surfaces to remove damaged areas. Saw cut straight joint lines parallel to the centerline of the trench. Cut offsets at right angles to the trench centerline.

B. Restore existing portland cement concrete driveways with a 8" layer of concrete reinforced with mat of #8 grade 60 rebar at 12” on-center each way on a 6” layer of PennDOT 2B coarse aggregate.

C. Restore existing asphalt driveways which are not be altered in kind or with minimum 2" layer wearing course over 6" layer of 2A aggregate.

3.07 CONCRETE CURB AND GUTTER REPAIRS

A. Replace curbs and gutters damaged by construction to match existing.

B. Reconstruct curbs and gutters to the first expansion joint on either side of the damaged portion. Install expansion joint material.

3.08 STORMWATER INLETS AND PIPING

A. Repair or replace storm water inlets and piping damaged by construction to match existing inlets.

B. The Resident Project Representative will determine whether the frame and grate assembly of each affected storm water inlet is suitable for reuse once it has been removed by Contractor.

C. Construct or repair storm water inlets and piping in accordance with relevant section of Publication 408 Specifications.

3.09 STREET SIGNAGE

A. Reinstall any signage removed to allow for construction activities at the original location.

END OF SECTION

SECTION 32 13 13 - PORTLAND CEMENT CONCRETE PAVING

PART 1 - GENERAL

1.01 SECTION DESCRIPTION

A. The Work of This Section Includes:

1. Concrete Sidewalks/Steps
2. Concrete Curbs
3. Concrete Driveway Aprons
4. Concrete Pads

1.02 QUALITY ASSURANCE

A. Reference Standards

1. American Concrete Institute

   ACI 301, 318

2. American Society for Testing and Materials (ASTM):

   A615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
   C31 Practices for Making and Curing Concrete Test Specimens in the Field
   C39 Test Method for Compressive Strength of Cylindrical Concrete Specimens
   C42 Methods of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
   C172 Method of Sampling Freshly Mixed Concrete
   C260 Specification for Air-Entraining Admixtures for Concrete
   D946 Specification for Penetration - Graded Asphalt Cement for Use in Pavement Construction

3. Pennsylvania Department of Transportation

   Publication 408 Specifications

B. Testing Laboratory

1. Compressive strength tests shall be performed by an independent testing laboratory engaged by and paid for by Owner.

1.03 SUBMITTALS

A. Certificates:

1. Submit certification from the concrete producer attesting that the concrete conforms to Section 704, Publication 408 Specifications for the class of concrete being used.
2. Submit certified results of compressive strength tests performed by an independent testing laboratory.
3. Submit a PennDOT approved Mix Design for each concrete class and use required.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Forms:

1. Forms shall be straight, free from warp and of sufficient strength to resist the pressure of concrete without springing. Forms and template which are worn, bent, warped or broken shall not be used.

2. For sidewalks, steps, pads and driveway aprons, use forms of wood or steel profiled to suit conditions.

3. For curbs, use forms of steel except for sharp curves and short tangent sections where wood forms may be used when approved by the Resident Project Representative. Metal forms shall be of approved sections and shall have a flat surface on top and wood forms shall be of a depth equal to the depth of the curb, designed to permit secure fastening of the face and back forms at the tops. These fastenings shall be constructed in a manner that will not obstruct satisfactory finishing and edging of the top of the curb but will permit removal of the inside or face forms. The outside or back forms shall be straight from top to bottom. The inside of the face forms shall have a batter from the top of the curb to the finished surface line of the pavement, as indicated on the drawings, and shall be straight from this line to the bottom.

B. Expansion Joint Filler: 1/2" thickness conforming to Section 705.1, Publication 408 Specifications.

C. Joint Sealing Material: Asphalt PG 64S-22 Sealant (Section 469 Publication 408)

D. Concrete Curing Material/Compound: Section 711.1 and 711.2(a), Publication 408 Specifications.

E. Coarse Aggregate: No. 2A per Section 703.2, Publication 408 Specifications.

F. Reinforcement Bars: ASTM A615; Grade 60, deformed billet steel bars, finish conforming to Section 709.1, Publication 408 Specifications and Bulletin 15.

G. Welded Steel Wire Fabric: Deformed type; unfinished, coiled rolls, conforming to gage and mesh size as noted on the Drawings and Sections 709.3 and 709.4, Publication 408 Specifications and Bulletin 15.

2.02 CONCRETE MIX

A. Conforming to Section 704, Publication 408 Specifications.

1. Requirements for State approved batch plants, design computations and plant inspection shall apply. The acceptability of concrete will be based on conformance with the Cement Concrete Criteria specified below and the results of the specified tests.

B. Cement Concrete Criteria:

1. All Concrete shall be as defined by PennDOT Publication 408, Section 704.

2. Submit fully signed PennDOT TR-4221 certification, dated in the year material will be placed, for each concrete mix design in accordance with Section 01 33 00. Concrete design mix shall be submitted to Engineer for approval prior to work commencement. No concrete shall be placed until Engineer has approved the design mix.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Subgrade Preparation

1. Verify gradients and elevations of subgrade.
2. Soft, spongy, organic or other unsuitable material shall be removed from the subgrade and replaced with dry, firm material.
3. Compact subbase and/or subgrade to a firm unyielding surface at the required depth below the finished line and grade of the required construction work as shown on the Drawings.

B. Aggregate Placement

1. Spread aggregate on prepared subgrade to form a bed of the required depth as shown on Drawings.
2. Compact aggregate thoroughly using mechanical tamping device.

3.02 FORMING

A. Sidewalks, Steps, Pads and Driveway Aprons

1. Place and secure forms to correct location, dimension and grade in a manner to prevent settlement or displacement. Provide sufficient horizontal and vertical support.
2. Radial forms shall be used for all sidewalks with a radius of less than 250 feet.
3. Clean and treat all forms and templates with an approved material as required to prevent the concrete from adhering thereto. Oil, bituminous paper or other material which will adhere to or discolor the concrete shall not be used.
4. Form sidewalks to provide for separate slabs twenty-four (24) feet in length.
5. Place premolded expansion joint filler in joints between slabs, adjacent to existing structures, between the sidewalk and driveway apron, and between the driveway apron and concrete curb. Place premolded expansion joint material vertical in position, in straight lines for the full depth of the concrete.

B. Curbs

1. Place and secure forms to correct location, dimension and grade in a manner to prevent settlement or displacement. Provide sufficient horizontal and vertical support.
2. Clean and treat all forms and templates with an approved material as required to prevent the concrete from adhering thereto. Oil, bituminous paper or other material which will adhere to or discolor the concrete shall not be used.
3. Provide construction joints in uniform lengths not exceeding 15.5 feet except where shorter sections are necessary for closures or curves. No section shall be less than four (4) feet. Saw cut joints may be provided in lieu of hand-formed construction joints.
4. Place premolded expansion joint material, cut to conform to the cross sectional area at all structures and at the end of the day's work.

3.03 REINFORCEMENT

A. Sidewalks, Steps, Pads and Driveway Aprons

1. Place steel reinforcement at the mid-height of sidewalks and driveway aprons.

2. Interrupt reinforcement at expansion joints.

3.04 PLACING AND FINISHING CONCRETE

A. General

1. Moisten subbase/subgrade to minimize absorption of water from fresh concrete.
2. For use, proportioning, mixing and placing, and quality of concrete, follow applicable sections of ACI 318.
3. Place concrete in accordance with ACI 301 and PennDOT Publication 408.
4. Do not disturb formwork components or reinforcement during placement of concrete.
5. Place concrete continuously between predetermined joints.
6. Cure and protect exposed concrete construction as specified in Section 501.3(k), Publication 408 Specifications

B. Field Tests of Concrete During Construction

1. Test each 50 cubic yards or fraction thereof of each class of concrete for compressive strength. Retain an independent testing laboratory to test cylinders at the expense of CONTRACTOR.
    a. Sample concrete in accordance with ASTM C172. One test for slump, air entrainment and air and concrete temperature will be taken from each concrete delivery.
    b. Prepare and cure one set of four (4) test cylinders in accordance with ASTM C31.
    c. Test cylinders in accordance with ASTM C39 at the following schedule: 1 @ 7 days, 2 @ 28 days and 1 held in reserve.
    d. One additional set of test cylinders will be taken during cold weather concreting, cured on job site under same conditions as concrete it represents.
2. If test cylinders fail to meet strength requirements, the Resident Project Representative may require core tests in accordance with ASTM C42 at the expense of CONTRACTOR.

C. Sidewalks, Steps, Pads and Driveway Aprons

1. Provide slopes as indicated on the Drawings. Slope sidewalks within the right-of-way towards the roadway.
2. Finish surface to a semi-smooth condition.
3. Divide sidewalk slabs between expansion joints into blocks four (4) feet in length by scoring transversely. Divide the width of the driveway apron equally. Score the concrete around any obstructions or structures within the sidewalk area. The scoring shall consist of a block eight (8) inches wider than the maximum dimension of the structure at the sidewalk elevation. Scoring shall extend for a depth of at least one-quarter (1/4) of the thickness of the concrete slab.

D. Curbs

1. Place concrete in the forms in horizontal layers not exceeding five (5) inches and spade sufficiently to eliminate all voids. A vibrator may be used when approved by the Resident Project Representative.

2. Provide drainage openings through curb at the elevation and of the size required as shown on the Drawings or as directed by the Resident Project Representative.

3. Provide depressed curb where shown on the Drawings or as directed by the Resident Project Representative.

4. Finish top surface of the curb true to line and grade in a smooth, neat and even manner.

5. Round the edges of the face and back of the top surface of the curb to a radius of not more than 3/4 inch and 1/4 inch respectively while the concrete is still plastic.

6. Saw cut joints where construction joints have not been hand-formed. Sawing of joints shall be done as soon as practicable after the concrete has set sufficiently to preclude raveling during the sawing operation and before any shrinkage cracking occurs. The saw cut depth may be decreased at the edge adjacent to the pavement to obtain a maximum depth that will avoid damage to the pavement. Provide tooled edges on construction joints.

3.05 RESTORATION

A. Backfilling

1. Perform backfilling in accordance as required adjacent to the construction following removal of forms in such a way as to not disturb the concrete construction and in accordance with Conshohocken Borough Specifications and Design Standards and the PennDOT standards.

B. Final Grading and Seeding or Sodding

1. Perform final grading and provide seeding or sodding as noted on the Drawings.

C. Concrete Joints at Asphalt Paving

1. Sealing material shall be applied at the joint between the concrete and asphalt paving.

END OF SECTION

SECTION 32.1416.10: CLAY PAVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Clay paver units
B. Bedding and joint/opening filler materials
C. Edge restraints
D. Geotextiles

1.02 REFERENCES

A. American Society of Testing Materials (ASTM):

1. C902 Standard Specification for Pedestrian and Light Traffic Paving Brick
2. C1272 Standard Specification for Heavy Vehicular Paving Brick
3. C136 Method for Sieve Analysis for Fine and Coarse Aggregate.
4. C67 Method of Sampling and Testing Brick and Structural Clay Tile.
5. D448 Standard Classification for Sizes of Aggregates for Road and Bridge

B. Definitions:

A. Base Course: Layer of open-graded washed aggregate beneath the bedding course comprised of small to medium particle-sized crushed stone (1/2" to 1" typ.). Recommended depth of base layer shall be 4" but shall not exceed 6".

B. Bedding Course: Commonly called the setting bed is the layer of sand directly beneath the clay paver units. Recommended depth of setting bed is 1".

C. Laying Face: The working edge of the pavement where the laying of the pavers is occurring.

D. Method Statement: The paver installer's and manufacturer's plan for construction and quality control of the pavers.

E. Sub-base Course: Layer of open-graded washed aggregate beneath the base course comprised of large particle-sized crushed stone (2-1/2" to 3" typ.). Recommended depth will vary depending on site conditions and specific water detention volume requirements. Minimum depth of sub-base course shall be 12".

F. Wearing Course: The top surface of the paver.

1.03 QUALITY ASSURANCE

A. Paver Installation Subcontractor Qualifications:

1. Utilize an installer having successfully completed clay paver installation similar in design, material and extent indicated on this project.
2. Utilize an installer holding a completion certificate from the Pave Tech School for Advanced Segmental Paving Permeable Paving Systems course or equivalent.

B. Review the manufacturers' quality control plan, paver installation subcontractor's Method Statement and Quality Control Plan with pre-construction meeting of representatives from the manufacturer, paver installer, general contractor, engineer and/or owner's representative.

1.04 SUBMITTALS

A. Submit shop or product drawings and

B. Submit clay paver product data.

1. Manufacturer's product catalog sheets with specifications.
2. Three representative full-size samples of each paver type, thickness, and color. Submit samples indicating the range of color expected in the finished installation.
3. Accepted samples become the standard of acceptance for the work of this Section.
4. Laboratory test reports certifying compliance of the clay pavers with ASTM C 902 or C1272.
5. Manufacturer's material safety data sheets for the safe handling of the specified materials and products.

C. Submit sieve analysis for grading of bedding materials per ASTM C136

D. Submit test results for compliance of paving unit requirements to ASTM C 902 or ASTM C 1272 from and independent testing laboratory.

E. Erosion and sediment control plan

F. Submit installer qualifications: provide satisfactory evidence that the installer complies with the qualifications set out in section 1.03.

1. The installer shall provide installation history, including references from projects of a similar size and complexity in writing with contact information, demonstrating to the owner's satisfaction their ability to perform the paver installation and related work indicated in the plans and specifications.
2. The installer shall have experienced personnel and a management capability to execute the work detailed in the project drawings and specifications. The installer's foreman should have a minimum of 5 years experience in the installation of unit pavers including clay pavers.

G. Schedule & Work Plan: submit a detailed schedule and work plan

1.05 MOCK-UPS

A. Install a 4 ft. x 4 ft. paver area. This area will be used to determine surcharge of the bedding layer, joint sizes, lines, laying pattern(s), color(s), and texture of the job. This area shall be the standard from which the work will be judged.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver brick pavers to the site in steel banded, plastic banded, or plastic wrapped cubes or on pallets capable of transfer by fork lift or clamp lift. Unload pavers at job site in such a manner that no damage occurs to the product.

1.07 ENVIRONMENTAL CONDITIONS

A. Do not install bedding or pavers during heavy rain or snowfall.

B. Do not install frozen bedding.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

Clay brick pavers have spacer bars on each unit. These insure a minimum joint width between each unit in which the aggregate is placed. Spacer bars help prevent contact of the edges with adjacent pavers and subsequent chipping.

A. Clay brick pavers shall be A Grade pavers manufactured/supplied by a member of the Brick Institute of America (BIA). The BIA manufacturer/supplier shall be:
   1. Name: **PINE HALL BRICK**
      Address: P. O. Box 11044
      2701 Shorefair Drive
      Winston-Salem, NC 27116-1044 Phone: (800) 334-8689
   2. Or Approved Equal.

B. Product name/shape, overall dimensions, and thickness of the permeable clay paver units shall be:
   1. Paver Type: Beveled Edge 4X8
      a. Material Standard: Comply with ASTM C1272.
      b. Color : Color and Pattern to be chosen from available standard selections. TBD by architect to coordinate with building materials.
      c. Size: 4 inches x 8 inches x 2.25 inches thick.
   2. Or Approved Equal.

C. Pavers shall meet the following requirements set forth in ASTM C 902, Specification for Pedestrian and Light Traffic Paving Brick and shall conform to the PX standard.

   1. Minimum average compressive strength of 10,000 psi.

   2. The average cold water absorption shall not be greater than 6% with no individual unit testing greater than 7%. Absorption test results may not be achieved through the use of sealers or other products applied to the clay paver.

   3. Resistance of 50 freeze-thaw cycles, when tested in accordance with ASTM C67. In addition, the clay paver must pass CSA-A231.2 freeze thaw test in saline solution without the use of sealers or other products applied to the paver. A test report must be submitted by the manufacturer.

   4. Dimensional tolerances should meet the PX standard. In addition, the dimensional tolerances around the mean values for length, width, and depth shall be 1/16". (Studies show that dimensional tolerances are directly linked to joint width size and proper interlock.)

   5. The pavers should be solid units without core holes or other perforations.

   6. The contractor shall ensure that the manufacturer conducts a test sampling of 24 pavers every 50,000 pavers manufactured to determine the pavers compliance with dimensional and water absorption characteristics. The 24 paver sample shall be representative of the color mix in the typical finished package and chosen on a consistent basis from one kiln car.

2.02 EDGE RESTRAINTS

A. Edge restraints are required on all installations. Edge restraints are to be aluminum as specified in the drawings. Install as per manufacturer's specifications.

2.03 FILTER GEOTEXTILE

A. A PennDOT Class 4 Type A non-woven geotextile fabric shall be placed on the subgrade prior to placement of the subbase stone as shown on the Drawings.

PART 3 EXECUTION

3.01 SUBGRADE

A. The site engineer shall verify that the sub-grade has been shaped and compacted in conformance to the lines, grades and cross-sections shown on the Drawings.

3.02 EDGE RESTRAINTS

A. All edge restraints shall be constructed as shown on the plans and in place prior to the installation of the bedding course and pavers.

3.03 BEDDING COURSE

A. The bedding course shall be spread loose in a uniform layer to give a depth after compaction of the pavers of two inches, plus or minus ½". The contractor shall screed the bedding course using either a mechanical screed beam apparatus or by the use of screed guides and boards.

B. The screeded bedding sand shall not be subjected to any traffic by either mechanical equipment or pedestrian use prior to the installation of the pavers. The voids left after the removal of the screed rails shall be filled with loose aggregate as the paver bedding course proceeds.

3.04 CLAY PAVERS

A. The pavers should be installed according to the information on the cube tag. The pavers should be laid from several cubes throughout the installation.

B. Lay pavers in the pattern as shown on the drawings. Lay pavers away from the existing laying face or edge restraint in such a manner as to ensure that the pattern remains square. Chalk lines (use a heavier chalk cord) shall be used upon the bedding course to maintain straight lines.

C. Pavers should be cut according to the instructions on the cube tag. Pavers shall be cut using a table mounted masonry wet saw.

D. Once the pavers have been placed upon the bedding course and all cut pavers have been inserted to provide the complete surface, inspect the pavers for damaged units and remove and replace those units. Once all pattern lines have been straightened, the void filler shall then be placed into the paver openings to the top of the chamfer on the pavers and the surface swept broom clean.

E. The pavement surface shall be compacted to achieve consolidation of the bedding course and pavers and brought to design levels and profiles by two passes of a suitable plate compactor. Compaction of the pavers shall be accomplished by the use of a vibratory plate compactor capable of a minimum of 4,500 pounds of compaction force. No compaction shall be permitted within three feet of unrestrained edges of the pavement. After compaction, inspect the pavers for damaged units and remove and replace those units.

F. Sweep polymeric sand into joints. Follow poly sand manufacturers application methods.

G. After completing compaction, the surface tolerances shall be plus or minus ½" from finished grades. The pavers shall be flush to ½" above edge restraints. Upon completion, the pavement surface shall be swept clean of all excess materials. Remove from the site all surplus materials, equipment and debris resulting from these operations.

END OF SECTION

SECTION 32.1723.16 - EPOXY PAVEMENT MARKINGS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This work is the furnishing and installation of reflectorized, two-component epoxy resin pavement markings of the color indicated, with glass beads, at the locations indicated. All long line markings are to be the epoxy resin material as specified below.

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials used shall be in accordance with most recent edition of PennDOT Publication 408, Section 964. All materials shall be provided from a source listed in Bulletin 15.

B. Epoxy Resin. Do not use polluting solvents or fillers.

1. Color. Furnish white and yellow pavement markings that satisfy the following chromaticity coordinates:

	1		2		3		4	
	x	y	x	y	x	y	x	y
White	0.330	0.370	0.355	0.345	0.310	0.300	0.285	0.325
Yellow	0.515	0.465	0.505	0.430	0.440	0.415	0.420	0.443

Furnish black epoxy that satisfies color chip 37038 of Federal Standard 595B and is equal to the quality of the white epoxy being used.

2. No Track Time. Dry to a no-track condition in 10 minutes or less when tested according to ASTM D 711 at a temperature of 75F ± 2F at a thickness of 20 mils ±1 mil with glass beads applied at a rate of 20 pounds per gallon of epoxy.

C. Glass beads shall conform to Section 1103.14 of PennDOT Publication 408, most recent edition.

D. Black Aggregate. Furnish with the following gradations:

Sieve Size	Retained (%)
No. 20	17 - 37
No. 30	45 - 65
No. 40	14 - 25

E. Furnish c with a copy of the manufacturer specifications for the proper mix ratios of the epoxy component, proper temperatures, proper mixing techniques, and any other necessary data to insure that the epoxy material is being properly installed.

PART 3 EXECUTION

3.01 GENERAL

A. Apply in accordance with applicable 67 Pa Code and PennDOT standards.

B. Employ traffic control measures in accordance with PennDOT Publication 213, Temporary Traffic Control Guidelines, at all times.

C. Construction shall be in accordance with PennDOT Publication 111, Traffic Control – Pavement Markings and Signing Standards

3.02 EQUIPMENT

A. Use application equipment that is capable of:

1. Spraying epoxy material mixed in the proper formulation conforming to manufacturer's requirements
2. Applying symbol markings and longitudinal lines with the specified glass bead application
3. Heating Epoxy Part A to satisfy manufacturer's recommendations
4. Heating Epoxy Part B to satisfy manufacturer's recommendations
5. Mixing Part A with Part B according to manufacturer's recommendations
6. Applying glass beads using the double drop method

B. Provide an operator for the equipment who is fully knowledgeable of all equipment operations and application techniques. Provide a pressure gauge on each proportioning pump to verify pressures. Position these gauges to be easily visible to the operator of the equipment and Resident Project Representative. Obtain from the manufacturer of the epoxy material being used, specifications for the proper mix ratios of the epoxy component, proper temperatures, proper mixing techniques, and any other data to ensure that the epoxy material is being properly installed. Furnish this information to Resident Project Representative at least 5 days before beginning work.

3.03 CONSTRUCTION

A. Surface Preparation: For proper adhesion, perform surface preparation of the road surface and provide the pretreatment according to Bulletin 15 or recommended by the manufacturer. Clean the roadway surface where the epoxy pavement markings will be applied. Remove all surface treatment, laitance, curing compound, or any contaminants that would hinder adhesion. Clear any loose dirt and other debris from the application area. Identify the location of the final pavement markings by applying spots on the pavement at 40-foot intervals. Resident Project Representative will approve the locations. Install epoxy on dry pavement only if the road surface and ambient temperatures are 40 F or higher unless otherwise approved by Resident Project Representative and acceptable to the manufacturer.

B. Before starting work, furnish four sample plates of each color of materials used. Prepare two plates with and two plates without glass beads or aggregate.

C. Uniformly apply the epoxy markings at a wet thickness of 20 mils ± 1 mil. A tolerance of ±1/4 inch from the indicated width will be allowed provided the variation is gradual and does not detract from the general appearance. For skip line patterns maintain a tolerance of ±6 inches for each 40-foot cycle and ±3 inches for each 10 foot skip line.

D. Apply glass beads immediately after application of the epoxy markings. Use the double drop method with a minimum rate of 10 pounds per gallon for Type A beads and 10 pounds per gallon for Type B beads or a total minimum of 20 pounds per gallon of epoxy. Uniformly distribute glass beads on the surface. Provide markings with an average minimum initial retroreflectivity of 250 mcd/m2/lux for white and 200 mcd/m2/lux for yellow. Under the direction and supervision of the Representative measure retroreflectivity with a 30-meter geometry

retroreflectometer conforming to ASTM E-1710 within 21 days after installation in accordance with PTM No. 431.

E. Apply black epoxy markings on Portland cement concrete. Place the black markings, flooded with black aggregate, immediately after all white skip line patterns. Use the same line dimensions for both colors.

3.04 PROTECTION OF SURFACES

A. After the application of epoxy material and glass beads, satisfactorily protect the markings from traffic for a minimum period of 30 minutes or until the epoxy has dried sufficiently to prevent dirt pick-up or tracking from vehicular traffic.

B. Defective Markings: Repaint marked or damaged areas as directed by Resident Project Representative. Remove any markings placed incorrectly and replace them as directed by Resident Project Representative. Repair those markings, which after application and drying, are determined to be defective by Resident Project Representative. Complete this work at no additional cost to Owner. Major problem areas and method of repair include the following:

1. Insufficient thickness or line width, uneven cross-section—Grind or blast clean defective material to remove a substantial amount of beads and to roughen the marking surface. Remove loose particles and debris with compressed air. Restripe the cleaned surface as specified in Section 3.03.

2. Inadequate retroreflectivity, glass bead coverage or retention—Restripe over the defective marking.

3. Poor adhesion, delaminating—Remove defective markings as specified in PennDOT Publication 408 Section 963 and clean pavement surface, including 1 foot beyond each end of the affected area. Remove loose particles and debris with compressed air. Restripe the marking on the cleaned surface as specified in Section 3.03.

C. Guarantee: Guarantee 90% of the pavement marking material against failure due to premature wear or poor adhesion resulting from materials or methods of application for a period of 180 days from the date of acceptance.

3.05 CENTERLINE APPLICATION

A. Where existing centerlines are visible and properly located, apply directly over existing pattern.

B. Where centerlines do not exist or are improperly located, apply at the correct location, as determined by Resident Project Representative. Remove the improperly placed markings as directed by Resident Project Representative in accordance with PennDOT Publication 408 Section 963.

C. On two-lane roadways, evenly divide the roadway. If a portion of the roadway on either or both sides is utilized for parking, evenly divide the traveled way.

3.06 EDGE LINE APPLICATION

A. Field check and paint roadway sections which are 20 feet or greater in width for more than 50% of their length as directed by Resident Project Representative.

END OF SECTION

SECTION 32.1723.33 - HOT THERMOPLASTIC PAVEMENT MARKINGS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This Work is the furnishing and installation of thermoplastic traffic lines and markings, of the indicated type and color with a surface application of glass beads. Thermoplastic pavement markings shall be used for all stop bars, gore striping, crosswalks, legends, and arrows.

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials used shall be in accordance with the most recent edition of PennDOT Publication 408, Section 960. All materials shall be provided from a source listed in Bulletin 15 and conforming to AASHTO M 249.

B. Glass beads shall conform to Section 1103.14, Type A, of most recent edition of PennDOT Publication 408.

PART 3 EXECUTION

3.01 GENERAL

A. Apply in accordance with applicable 67 Pa Code and PennDOT standards.

B. Employ traffic control measures in accordance with MUTCD Chapter 6 and PennDOT Publication 213, Temporary Traffic Control Guidelines, at all times.

C. Construction shall be in accordance with PennDOT Publication 111, Traffic Control – Pavement Markings and Signing Standards

3.02 CONSTRUCTION

A. Application for Hot Thermoplastic:

1. Surface Preparation: For proper adhesion, perform surface preparation of the road surface and provide the pretreatment according to Bulletin 15 or recommended by the manufacturer. Clean the roadway surface where the hot thermoplastic pavement markings will be applied. Remove all surface treatment, laitance, curing compound, or any contaminants that would hinder adhesion. Clear any loose dirt and other debris from the application area. Identify the location of the final pavement markings by applying spots on the pavement at 40-foot intervals. The Resident Project Representative will approve the locations. Apply on dry pavement when the air and roadway temperatures are between 50F and 90F and when the wind speed is less than 20 miles per hour.

2. Thermoplastic: Uniformly apply the markings at a minimum thickness of 90 mils ± 3 mils. A tolerance of ± 1/4 inch from the specified width will be allowed provided the variation is gradual and does not detract from the general appearance. For skip line patterns maintain a tolerance of ± 6 inches for each 40-foot cycle and ± 3 inch for each 10-foot skip line.

3. Glass Beads: Apply glass beads immediately after application of the markings at a minimum rate of 10 pounds per 100 square feet of markings. Uniformly distribute glass beads on the surface. Provide markings with an average minimum initial retroreflectivity of 300 mcd/m2/lux for white. Under the direction and supervision of the Representative, measure retroreflectivity with a 30-meter geometry retroreflectometer, conforming to ASTM E-1710 within 21 days after installation in accordance with PTM No. 431.

B. Protection of Surfaces

1. Provide satisfactory protection for pavement markings for at least 30 minutes or until material has dried sufficiently to prevent dirt pick-up and tracking from vehicular traffic.

2. Defective Markings: Repaint marked or damaged areas as directed by Resident Project Representative. Remove any markings placed incorrectly and replace them as directed by Resident Project Representative or Owner. Repair those markings, which after application and drying, are determined to be defective by Resident Project Representative. Complete this work at no additional cost to Owner. Major problem areas and method of repair include the following:

   (a) Insufficient thickness or line width, uneven cross-section—Prepare defective material by grinding or blast cleaning to remove a substantial amount of beads and the marking surface is roughened. Remove loose particles and debris with compressed air. Restripe the cleaned surface as specified in Section 3.02.A.2.

   (b) Inadequate retroreflectivity, glass bead coverage or retention—Remove defective markings and clean pavement surface, including 1 foot beyond each end of the affected area. Remove loose particles and debris with compressed air. Restripe the marking on the cleaned surface as specified in Section 3.02.A.3.

3. Guarantee: Where directed, remove and replace material that has not remained within close conformity to location or has not remained effective in performing useful service for a period of 180 days from the date of acceptance. The minimum acceptable service is as follows:

   (a) Longitudinal Markings. 90% of material remains in each 1,000-foot section of marking where the intersection unit is defined as material on an approach leg within 160 feet of the intersection.

   (b) Transverse Markings, Legends, and Symbols. 90% of material remains for each individual legend, symbol, crosswalk, gore stripe or stop line.

END OF SECTION

SECTION 32.1726 - DETECTABLE WARNING SURFACE PANEL

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This Work is the furnishing and installation of detectable warning surface (DWS) panels on designated surfaces to provide a tactile warning for pedestrians with visual impairments in accordance with the Drawings, Contract Documents, and as directed by the Resident Project Representative.

1.02 SUBMITTALS

A. Certifications: Submit manufacturer’s written literature describing product, installation procedures, maintenance practices, and documentation indicating that DWS panel will meet or exceed Product requirements.

B. Shop drawings: Submit fabrication details, panel surface profile, fastener locations, and plans of panel placement, including joints and any field cutting.

C. Warranty: Submit manufacturer's minimum five (5) year warranty from date of final completion, including defects, breakage, and deformation.

D. Color selection shall be as approved by the Resident Project Representative.

PART 2 PRODUCTS

2.01 MATERIALS

A. DWS panel to be provided from the qualified DWS product list in the current version of PennDOT Bulletin 15 (Publication 35).

B. DWS panel shall be compliant with most recently adopted Department of Justice ADA Standards and International Code Council (ICC) A117.1 Accessible and Usable Buildings and Facilities, including related to truncated domes and slip resistant surface. Slip resistance value shall be equal to or exceed 0.8 wet/dry per ASTM C 1028.

C. DWS panel color shall contrast visually with adjacent walkway surfaces, either light-on-dark or dark-on-light, for the full width of ramp. Use of a DWS panel employing a color coating is prohibited.

PART 3 EXECUTION

3.01 INSTALLATION

A. Coordinate the DWS panel installation with the underlying sidewalk or other designated surface. Place and finish the underlying surface true and smooth to the required dimensions and slope prior to DWS panel placement. Construct notch to provide a full-thickness underlying surface under the DWS panel. For sidewalk, the notch shall be constructed in accordance with the most recent version of the Detectable Warning Surface Embedding detail of PennDOT Publication 72 RC-67.

B. Maintain a minimum temperature of 40°F in spaces to receive the DWS panel for at least 24 hours before installation, during installation, and for not less than 24 hours after

installation.

C. Perform DWS panel installation according to manufacturer's written instructions.

D. Install DWS panel such that the top of the panel (not the top of the truncated dome) is fully seated and flush with the adjacent surface.

E. Align truncated domes on the DWS panel on a square grid pattern in the predominant direction of the ramp and perpendicular to the curb. Comply with the most recent version of the Detectable Warning Surface (DWS) on Curved Surfaces detail of PennDOT Publication 72 RC-67 for installations along curved surfaces.

F. Provide a minimum 24 inch deep DWS, measured in the direction of pedestrian travel, across the full width of ramp at the grade break near the street edge. Extend the detectable warning panel across the full width of the curb ramp or flush surface.

G. Place at least one corner of the DWS panel within 6 inches minimum and 8 inches maximum from the face of curb. No other point on the leading edge of the DWS panel may be more than 60 inches from the face of curb. Where no curbs exist, place the DWS panel within 6 inches minimum to 8 inches maximum from the respective to edge of roadway.

H. Field cut the DWS panel only in accordance with the manufacturer's written instructions while maintaining compliance with the most recently adopted Department of Justice ADA Standards and International Code Council (ICC) A117.1 Accessible and Usable Buildings and Facilities for truncated dome spacing.

3.02 CLEANING AND PROTECTION

A. Package DWS panel to prevent damage in shipment and handling. Store DWS panel in a clean, dry condition and within a temperature range of 40°F – 90°F to prevent contamination or damage to the panel.

B. Protect DWS panel against damage during construction period in compliance with manufacturer's recommendations.

C. Do not allow concrete to cure on DWS panels. Clean excess concrete from DWS panel immediately following installation using a method recommended by the manufacturer.

D. Protect the surface finish of the DWS panel. Do not scratch, chip, or otherwise damage the surface.

END OF SECTION

SECTION 32.3113 - ARCHITECTURE METAL SCREENING GATES

PART 1 - GENERAL:

1.01 SECTION INCLUDES:

A. The work in this section shall include furnishing all labor, materials, equipment and appliances necessary to complete all commercial ornamental swing gates required for this project in strict accordance with this specification section and drawings.

1.02 REFERENCES:

A. Underwriters Laboratory Gate Operator Requirements (UL 325).

B. ASTM F 2200 Standard Specification for Automated Vehicular Gate Construction.

C. American Welding Society AWS D1.2 Structural Welding Code

D. ASTM F 900 Standard Specification for Industrial and Commercial Swing Gates.

1.03 SUBMITTALS:

A. Product Data:

1. Provide manufacturer's printed specifications and installation instructions.

B. Shop Drawings:

1. Supply shop drawings showing the gate system, including details of all major components to be provided.

2. Include details of gate construction, gate height, and post spacing dimensions.

C. Certifications:

1. The aluminum welders and welding process must be certified per AWSD1.2

PART 2 - PRODUCTS:

2.01 SWING GATE MANUFACTURER:

A. The swing gate shall be manufactured by PalmSHIELD, 12330 Cary Circle, La Vista, Nebraska 68128

B. Approved Substitution: All other systems must be submitted to the design team in accordance with substitution requirements as set forth in the general provisions of the specification manual for approval prior to the bid date. Products submitted after the bid date will not be approved.

C. Gate manufacturer shall provide independent certification as to the use of a documented Welding Procedure Specification and Procedure Qualification Record to insure conformance to the AWS D1.2 welding code. Upon request, Individual Certificates of Welder Qualification documenting successful completion of the requirements of the AWS D1.2 code shall also be provided.

2.02 GATE CONSTRUCTION DETAILS:

A. Model: Horizontal Louver Blade Double Drive Gate – Basis of Design.

B. Gate Frame:

1. The gate frame shall be fabricated from 6063-T52 aluminum alloy extrusions. The top member shall be a 3” x 3" x ¼” aluminum structural tube extrusion weighing not less than 3.23 lb/ft. The bottom member shall be a 3” x 3" x ¼” aluminum structural tube weighing not less than 3.23 lb/ft..
2. Vertical Members:The vertical members a 6063-T52 aluminum structureal tubet the ends of the opening portion of the frame shall be 3” x 3” x ¼” (76mm x 76mm) in the cross section weighing not less than 3.23 lb/lf (1.6kg/m).
3. All welds on the gate frame shall conform to Welding Procedure Specification and Procedure Qualification Record to insure conformance to the AWS D1.2 Structural Welding Code. All individual welders shall be certified to AWS D1.2 welding code.
4. Each gate leaf shall be provided with a minimum of two pivoting gorilla hinges to allow proper operation, and shall be connected to the gate side of the hinge by means of a minimum of two through-bolts.

C. Diagonal Bracing:

1. Diagonal "X" bracing of 1/4” diameter stainless steel cable shall be installed throughout the gate to provide additional vertical adjustment. Provide ¼” Aluminum gusset plates type 6061-T6, at each gate corner for attachment of diagonal cable bracing. Plates shall be welded to aluminum gate frame tubes.

D. Louver Reinforcing:

1. Provide ¼” x 1” aluminum flat bar ribs, Type 6061-T6, as required for louver reinforcing.

E. Posts:

1. Gate hanger posts shall be sized in accordance with gate dimensions as specified by the manufacturer. Height of the post and depth of footing shall be as specified by the engineer.

F. Lock:

1. Double gates shall have a Ultra Latch as manufactured by American Fence Company and each leaf shall have a lockable drop rod assembly for securing the gate to the adjoining surface below. Provide a galvanized steel sleeve at each drop rod to accept the drop rods.

G. The gate shall be completed by installation of approved filler as specified. The gate filler will be a architectural solid screening as defined.

1. 6” x .93 louvers of 6063-T6 aluminum alloy extrusion. Louvers shall be horizontal mounted at 2-3/8” offset spacing with ½” overlap, typical.

H. Finish:

1. Gate to be color coated with polyester powder as specified. The gate and all accessories shall be pretreated chemically by sand blasting or other acceptable method to ensure proper

coating adherence. Gate posts (to be supplied by others) shall be galvanized or coated as specified by the design team.

PART 3 - EXECUTION:

3.01 INSTALLATION:

A. Excavate, place concrete and install specified sized posts as detailed, and in accordance with approved shop drawings. Install hinges on gate frame and gateposts. Make final adjustments to maintain alignment of gate leaves. Install equipment of this section in strict accordance with the company's printed instructions unless otherwise shown on the contract drawings.

B. The gate and installation shall conform to ASTM F 900 standards for aluminum swing gates.

END OF SECTION 32.3113

SECTION 32.3119 - ARCHITECTURAL METAL ROOF SCREENING

PART 1 – GENERAL

1.1. DESCRIPTION

A. This section describes the following fence system:

1. Fixed louver modular fencing panels fabricated with extruded aluminum louvers and flat aluminum bars including extruded aluminum fence posts and aluminum louver gates. Louvered security fence and gates shall be furnished and installed as shown on the plans and specified herein, overall height of vertical louver framework shall be as indicated on the Drawings..

1.2. REQUIREMENTS

A. Furnish materials, labor, expertise and equipment necessary to complete all work specified in this section and as shown on the drawings.

B. Structural Performance: Provide product and installation capable of withstanding the effects of gravity lads and the following loads and stresses within limits and under conditions indicated.

i. Uniform pressure of 30 lbf/sq. ft. acting inward or outward.

ii. Thermal Movements resulting from a temperature change (range) of 120 degrees Fahrenheit ambient and 180 degrees Fahrenheit material surfaces.

1.3. SUBMITTALS

A. Shop drawings and manufacturer's literature: Provide specifications and construction detail drawings to substantiate quality of materials and provide details of fabrication and installation.

B. Submittals shall be in accordance with standard construction practices to include complete detailed layout of all panels, posts, and gates. Submittals shall include plan layout, elevations and section views of panels, posts and gates.

C. Certificate: manufacturer’s certification that materials meet specification requirements.

1.4. REFERENCES

A. ASTM B 209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

B. ASTM B 221 – Standard Specification for Aluminum and Aluminum-Ally Extruded Bars, Rods, Wire, Profiles and Tubes.

C. ASTM D3363 – Standard Test Method for Film Hardness by Pencil Test.

D. ASTM D2794 – Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation.

E. ASTM B117 – Standard Practice for Operating Salt Spray Apparatus.

F. ASTM D822 – Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.

G. AWS D!.2 Structural Welding Code – Aluminum.

1.5. QUALITY ASSURANCE

A. Installation of fence and materials shall conform to the requirements of the fence manufacturer.

B. The fence shall be warranted from any defects in materials and workmanship for a period as specified in the relevant section of the contract documents.

PART 2 – PRODUCTS

2.1. MATERIALS

A. Louvered security fence:

1. Approved Louvered Fence System, Manufacturer:

a. “PalmSHIELD”

2. Material Descriptions:

a. Extruded Aluminum: ASTM B 221, Alloy 6063 – Temper T-6.

b. Sheet Aluminum: ASTM B211, Alloy 6063 – Temper T6.

c. Powder Coating Material Hardness: ASTM 3363 2H.

2. Louver Panel Description:

    a. Louver Panel Height: As indicated on the Drawings.

    b. Louver Panel Width: Not to exceed 6'.

    c. Louver fencing system consisting of horizontal, fixed louver, modular fence panels fabricated with extruded aluminum framing bars and supported by extruded aluminum fence posts.

    d. Extended Flange to allow for a minimum of ½ inch overlap of louvers for 100% direct visual screening.

    e. Fixed Louver Bars: 0.1250 inch thick louver with an installed profile of 2 inch X 2.873 inch tall.

    f. Vertical Framework: PalmSHIELD exclusive 4" wide x 2" deep x 1/8" tapered aluminum channel compression profile. Patent pending.

    g. Horizontal Top Cap: 4" x 3" x 1/8" aluminum channel.

    h. Horizontal Bottom Cap: 4 inch x 3 inch x 1/8" aluminum channel.

    i. Cross Bar: 1 inch x 1/8 inch aluminum flat bar.

3. Fence Posts:

    a. Panel posts shall be PalmSHIELD exclusive 4 inch deep x 3 inch wide I-Beam Post. Patent pending. extruded tubular aluminum sections with solid aluminum caps. Length as specified on the contract drawings.
        1. 5/16" double walled webbing with 5/8" wide cavity.
        2. 5/16 flanges
        3. Inner flange mechanically fastened to webbing with 3/8" stainless steel fastener.
        4. Outer flange and webbing form one extrusion.

    b. On center post spacing shall be as specified by manufacturer.

    c. All fence posts to be plated with 10" x 10" x ¾" aluminum plates with four ¾" hole for anchors.

4. Fittings and accessories: All fittings and accessories shall be stainless steel and

sized as specified by the fence manufacturer. Fence panels to be attached to posts with ¼" x 1" stainless steel screws. Panels and posts are predrilled to support level installation.

5. Anchor Bolts: Anchor bolts shall be as detailed on the Drawings and adequate to support loads based on screening height, exposures and loading.

6. Factory Finish: Aluminum fence panels, posts and gates shall receive polyester powder coating.

   a. Polyester powder coating: Electrostatically applied colored polyester powder coating heat cured to chemically bond finish to metal substrate.

   b. Color shall be as selected by Owner.

   c. Minimum hardness measured in accordance with ASTM D3363 2H.

   d. Direct impact resistance tested in accordance with ASTM D2794. Withstand 160 inch-pounds.

   e. Salt spray resistance tested in accordance with ASTM B117: No undercutting, rusting, or blistering after 500 hours in 5 percent salt spray at 95° F and 95% relative humidity after 1,000 hours, less than 3/16 inches undercutting.

   f. Weatherability tested in accordance with ASTM D822: No film failure and 88 percent gloss retention after 1 year exposure in South Florida with test panels tilted 45°.

PART 3 – EXECUTION

3.1 INSPECTION

A. Verify that final grading in fence location is completed and without irregularities which will interfere with fence installation. PalmSHIELD is designed to be installed on a level surface. Variations in height, slopes, stairs steeping shall be shown on contract drawings and on submittal drawings.

B. Field verify all fence dimensions and layout prior to commencing installation.

C. Do not commence work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fence in accordance with manufacturer's installation instructions.

B. Install fence plumb and level. Posts are plated and mounted to top of surface.

C. Do not install bent, bowed or otherwise damaged panels. Remove damaged components from site and replace.

D. Secure fence panels with stainless with ¼" x 1" stainless steel screws to fence posts. All posts and panels will be predrilled to support level installation.

END OF SECTION 32.3119

SECTION 32.9200 - FINISH GRADING, SEEDING, AND SODDING

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Work of This Section Includes, but is not limited to:
   1. Placing topsoil
   2. Soil conditioning
   3. Finish grading
   4. Seeding
   5. Sodding
   6. Maintenance

B. Restore lawn areas as specified and indicated on the Drawings.

C. Refer to Seeding and Mulching Schedule on E&S Notes Plan for seeding restoration requirements at each specific location of Work.

1.02 QUALITY ASSURANCE

A. Testing Agency:
   1. The Contractor has the option to use soil testing to justify decreasing lime and fertilizer rates. When soil testing is selected by the Contractor, the soil and soil supplement testing shall be performed by a Soils Testing Laboratory engaged and paid for by the Contractor and approved by the Engineer. Collect soil samples under the direction of the Resident Project Representative.

B. Reference Standards:
   1. Pennsylvania Department of Transportation Publication 408 Specifications, most recent edition
   2. Pennsylvania Seed Act of 1965, Act 187, as amended
   3. Agricultural Liming Materials Act of 1978, P.L. 15, No. 9 (3P.S. 132-1), as amended
   4. Pennsylvania Soil Conditioner and Plant Growth Substance Law, Act of December 1, 1977, P.L. 258, No. 86 (3P.S.68.2), as amended'
   5. Rules for Testing Seeds of the Association of Official Seed Analysts

1.03 SUBMITTALS

A. Samples:
   1. When directed, furnish three strips of sod, 4-1/2 feet long by 12" wide, laid on 3" of topsoil and tamped in place in accordance with Section 01 33 00. The samples shall be representative of the sod and workmanship to be provided.

B. Certificates:
   1. Prior to use or placement of material, submit certifications of material composition of the following for approval:
      a. Topsoil analysis
      b. Fertilizer

c. Lime
d. Seed mixture(s)

2. If soil tests are performed to justify decreased lime and fertilizer rates, submit certified soil sample analyses, including laboratory's recommend soil supplement formulation.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Seed:

1. Deliver seed fully tagged and in separate packages according to species or seed mix. Seed which has become wet, moldy, or otherwise damaged in transit or storage will not be accepted.

B. Sod:

1. Mow sod in the field to a height of not more than 2-1/2" within 5 days prior to lifting.

2. Cut sod to a depth equal to the growth of the fibrous roots, but in no case less than 1-1/2", exclusive of grass and thatch. Do not cut sod when the ground temperature is below 32 degrees Fahrenheit.

3. Deliver sod to the project site within 24 hours after being cut and place sod within 36 hours after being cut. Do not deliver small, irregular, or broken pieces of sod.

4. During wet weather, allow sod to dry sufficiently to prevent tearing during handling and placing. During dry weather, moisten sod to ensure its vitality and to prevent dropping of the soil during handling. Sod which dries out will be rejected.

PART 2 - PRODUCTS

2.01 TOPSOIL

A. Having a pH of between 6.0 and 7.0; containing not less than 2% or more than 10% organic matter as determined by AASHTO T194.

B. Fertile friable loam, sand loam, or clay loam which will hold a ball when squeezed with the hand, but which will crumble shortly after being released.

C. Free of clods, grass, roots, or other debris harmful to plant growth.

D. Free of pests, pest larvae, and matter toxic to plants.

2.02 FERTILIZER

A. Basic Dry Formulation Fertilizer:

1. Analysis 0-20-20 as defined by the Pennsylvania Soil Conditioner and Plant Growth Substance Law.

B. Starter Fertilizer:

1. Analysis 10-5-5 or 12-6-6 as defined by the Pennsylvania Soil Conditioner and Plant Growth Substance Law.

2.03 LIME

A. Raw ground limestone conforming to Section 804.2(a), PennDOT Publication 408 Specifications.

2.04 SEED

A. Fresh, clean, dated material from the last available crop and within the date period specified, with a date of test not more than 9 months prior to the date of sowing. Percentage of pure seed present shall represent freedom from inert matter and from other seeds distinguishable by their appearance. All seeds will be subject to analysis and testing.

2.05 SEED MIXTURES

A. Temporary Seeding Specification Formula E:

100% Annual Rye Grass

B. Permanent Seeding Specification Formula B

50% Kentucky Bluegrass Mixture
30% Pennlawn Red Fescue
20% Perennial Ryegrass Mixture

2.06 INOCULANT

A. Inoculate leguminous seed before seeding with nitrogen fixing bacteria culture prepared specifically for the species.

B. Do not use inoculant later than the date indicated by the manufacturer.

C. Protect inoculated seed from prolonged exposure to sunlight prior to sowing.

D. Re-inoculate seed not sown within 24 hours following initial inoculation.

2.07 MULCHING MATERIALS

A. Mulches for seeded areas shall be one, or a combination of, the following:

1. Hay:
   a. Cured to less than 20% moisture content by weight.
   b. Contain no stems of tobacco, soybeans, or other coarse or woody material.
   c. Timothy hay or mixed clover and timothy hay.

2. Straw:
   a. Cured to less than 20% moisture content by weight.
   b. Contain no stems of tobacco, soybeans, or other coarse or woody material.
   c. Wheat or oat straw.

3. Wood Cellulose:
   a. No growth or germination inhibiting substances.
   b. Green, air dried. Packages shall not exceed 100 pounds.
   c. Requirements:

Moisture content:	12% + 3%
Organic Matter:	98.6% + 0.2% on the oven dry basis.
Ash Content:	1.4% + 0.2%
Minimum Water-Holding Capacity:	1,000%

4. Mushroom Manure:
   a. Organic origin, free of foreign material larger than 2" and substances toxic to plant growth.
   b. Organic Matter: 20% minimum
   c. Water-Holding Capacity: 120% minimum
   d. pH: 6.0

2.08 SOD

A. At least three year old, well-rooted Turf-type Tall Fescue blend sod containing a growth of not more than 10% of other grasses and clovers.

B. Free from noxious weeds such as Bermuda grass, wild mustard, crab grass, and kindred grasses.

PART 3 - EXECUTION

3.01 TIME OF OPERATIONS

A. Apply seed within the following time periods unless otherwise directed by Engineer.

• All seed mixes unless noted otherwise	March 15 to June 1 August 1 to October 15
• Formula T	March 15 to October 15
• Wetlands seed mixes	April 1 to June 15 August 16 to September 15

B. Formula T to be utilized for temporary stabilization of areas disturbed by construction may be applied anytime.

3.02 PREPARATION OF SUBGRADE

A. "Hard pan" or heavy shale:

1. Plow to minimum depth of 6".
2. Loosen and grade by harrowing, discing, or dragging.
3. Hand rake subgrade. Remove stones over 2" in diameter and other debris.

B. Loose loam, sandy loam, or light clay:

1. Loosen and grade by harrowing, discing, or dragging.
2. Hand rake subgrade. Remove rocks over 2" in diameter and other debris.

3.03 PLACING TOPSOIL

A. Replace topsoil and spread over the prepared subgrade to obtain the required depth and grade elevation. Final compacted thickness of topsoil shall not be less than 4".

B. Hand rake topsoil and remove all materials unsuitable or harmful to plant growth.

C. Do not place topsoil when the subgrade is frozen, excessively wet, or extremely dry.

D. Do not handle topsoil when frozen or muddy.

3.04 TILLAGE

A. After seed bed areas have been brought to proper compacted elevation, thoroughly loosen to a minimum depth of 4" by discing, harrowing, or other approved methods. Do not work topsoiled areas when frozen or excessively wet.

B. Liming:

1. Distribute limestone uniformly at a rate of 90 pounds per 1,000 square feet.
2. Thoroughly incorporate into the topsoil to a minimum depth of 4".
3. Incorporate as a part of the tillage operation.

C. Basic Fertilizer:

1. Distribute basic fertilizer uniformly at a rate of 25 pounds per 1,000 square feet.
2. Incorporate into soil to depth of 4" by approved methods.
3. Incorporate as part of tillage operation.

D. Liming and Fertilizer rates may be decreased if lesser rates are indicated by soil tests provided by the Contractor.

3.05 FINISH GRADING

A. Remove unsuitable material larger than 2" in any dimension.

B. Uniformly grade surface to the required contours without the formation of water pockets.

C. Rework areas which puddle by the addition of topsoil and fertilizer. Re-rake.

D. Distribute starter fertilizer at the following rates:

10-5-5: 10 pounds per 1,000 square feet.
12-6-6: 10 pounds per 1,000 square feet.

E. Incorporate starter fertilizer into the upper 1" of soil.

3.06 SEEDING

A. See E&S Plans and Section 2.05 for seed mix to be utilized.

B. Uniformly sow specified seed mix at the rate noted by seed supplier by use of approved hydraulic seeder, power-drawn drill, power-operated seeder, hand-operated seeder or by hand. Do not seed when winds are over 15 mph.

C. Upon completion of sowing, cover seed to an average depth of 1/4" by hand re-raking or approved mechanical methods.

3.07 MULCHING

A. Mulch within 48 hours of seeding.

B. Place hay and straw mulch in a continuous blanket at a minimum rate of 135 pounds per 1,000 square feet.

1. Anchor hay or straw mulch by use of twine, stakes, wire staples, paper, or plastic nets.
2. Emulsified asphalt may be used for anchorage provided it is applied uniformly at a rate not less than 31 gallons per 1,000 square yards.
3. Apply approved chemical mulch binders at the manufacturer's recommended rate.

C. Chemical mulch binders or a light covering of topsoil may be used for anchorage when the size of the area precludes the use of mechanical equipment.

D. Apply wood cellulose fiber hydraulically at a rate of 35 pounds per 1,000 square feet.

1. Incorporate as an integral part of the slurry after seed and soil supplements have been thoroughly mixed.

E. Spread mushroom manure uniformly to a minimum depth of 1/2" or to the depth indicated on the Drawings.

F. When mulch is applied to grass areas by blowing equipment, the use of cutters in the equipment will be permitted to the extent that a minimum of 95% of the mulch is 6" or more in

length. For cut mulches applied by the blowing method, achieve a loose depth in place of not less than 2".

G. When mulching by the asphalt mix method, apply the mulch by blowing. Spray the asphalt binder material into the mulch as it leaves the blower. Apply the binder to the mulch in the proportion of 1.5 to 2.0 gallons per 45 pounds of mulch.

1. Protect structures, pavements, curbs, and walls to prevent asphalt staining.

2. Erect warning signs and barricades at intervals of 50 feet or less along the perimeter of the mulched area.

3. Do not spray asphalt and chemical mulch binders onto any area within 100 feet of a stream or other body of water.

3.08 SODDING

A. Prior to sod placement, complete soil preparation or topsoiling.

B. Apply lime and fertilizer as specified. Work into the soil a minimum of 2".

C. Do not place sod when the temperature is lower than 32 degrees Fahrenheit.

D. Place sod by hand with tight joints and no overlap. Transverse joints shall be broken or staggered.

E. Place sod so that the top of the sod is flush with the surrounding grade.

F. Use of tools which damage the sod or dumping of sod from vehicles will not be permitted.

G. Water sod to the saturation point immediately after placement.

H. After watering, tamp with an approved tamper to close all joints and insure close contact between sod and sod bed. After tamping, the sod shall present a smooth, even surface free from bumps and depressions. If so directed, use a light roller, weighing not more than 65 pounds per foot of roller width to complete firming and smoothing the sod.

I. When placing sod in ditches, place the strip with the long dimension at right angles to the flow of water. At any point where water will start flowing over a sodded area, the upper edge of the sod strips shall be turned into the soil below the adjacent area and a layer of compacted earth placed over this juncture to conduct the water over the edge of the sod.

J. In ditches and on slope areas, stake each strip of sod securely with at least 1 wood stake for each 2 square feet of sod. Stakes shall be 1/2" by 1" with a length of 8" to 12". Drive stakes flush with the top of the sod, with the long face parallel to the slope contour.

3.09 MAINTENANCE OF NEWLY SEEDED AND SODDED AREAS

A. Maintenance of grass areas shall consist of watering, mowing, weeding, re-seeding and/or re-sodding, edging and repair of depressions, washouts or gullies as necessary to obtain a stabilized lawn area. Maintenance shall continue until Owner’s Representative accepts the project.

B. In the absence of rainfall, during the first week of seed or sod installation, watering shall be performed daily by the Contractor or as often as deemed necessary by the Owner’s Representative. Water must be in sufficient quantities to maintain moist soil to a depth of 4 inches. The total shall be equal to the equivalent of at least 1 inch of water per week. Watering shall continue until the stabilized lawn area is accepted. For seeded areas, bare spots, which persist after three weeks of favorable growing weather, shall be re-cultivated, re-seeded, raked and rolled. Re-seeding of bare spots shall be done as many times as necessary until an

acceptable stabilized lawn area is established. For sodded areas, bare spots shall be re-sodded until deemed acceptable. If the turf stand is not accepted by the following seeding and sod season, the Contractor shall re-seed or sod and fertilize, as necessary, the unaccepted areas at no additional charge to the Owner.

1. If lawn area provides between 40% and 90% ground coverage, overseed and fertilize using half of the rates originally applied.
2. If lawn area provides less than 40% coverage, reestablish stand following original rates and procedures.

C. Flooded, washed-out, rilled or otherwise damaged or defective areas of seeding, sod, mulch, grade, swales or berms shall be reconstructed and all grades re-established in accordance with the grade plans or other specifications or when, in the judgment of the Owner's Representative, such defects or damages are the result of poor workmanship, or failure to meet the requirements of the specifications.

D. All mowing shall be the Contractor's responsibility until final acceptance of the project. No mowing shall remove more than one-third of the grass blade length. Heavy mowing, resulting in grass piles shall be "double mowed" or the Contractor shall remove piles. Height of the grass shall be maintained between two and a half and three inches, unless otherwise specified.

E. Following are some examples of delays in final acceptance of a project:

1. Improper Grades:
   a. Low or high spots on flat or fairly level areas.
   b. Improper drainage such as, swales, low areas, rip-rapped outlets and paved areas.
   c. Washed out or rilled areas.
   d. Exposed debris.
2. Turf Grass Conditions:
   a. Poor or thin stand; improper application of sod, dead grass or sod; use of seed mixtures or sod, other than approved in specifications.
   b. Improper fertilizer application - Uneven spreading, insufficient amounts, failure to re-fertilize during extended acceptance.
   c. Persistent weeds established in turf areas.

F. Seeded areas shall be maintained by the Contractor until fully established and accepted by the Owner. Fully established grass areas shall meet the specification for 'stabilized lawn area' as noted on the Drawings.

END OF SECTION

SECTION 33.4100 - STORM DRAIN PIPE

PART 1 - GENERAL

1.01 SECTION DESCRIPTION

A. This Work is the supply and construction of storm sewer pipelines in accordance with the Drawings, Contract Documents, and as directed by the Resident Project Representative.

1.02 QUALITY ASSURANCE

A. Reference Standards:

1. Pennsylvania Department of Transportation:

Publication 408 Specifications

Publication 72 Standards for Roadway Construction

1.03 SUBMITTALS

A. Manufacturer's Literature:

1. Submit manufacturer's descriptive literature for the following items in accordance with Section 01 33 00:

- Pipe
- Pipe fittings
- Joints

2. Submit manufacturer's instructions and recommendations for the following items in accordance with Section 01 33 00

- Assembly of joints

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. During loading, transporting and unloading, exercise care to prevent damage to materials.

B. Do not drop pipe or fittings.

PART 2 - PRODUCTS

2.01 REINFORCED CONCRETE PIPE

A. Pipe and Fittings:

1. Section 601.2(a)3, Publication 408 Specifications

B. Joints:

1. Bell and spigot, or

2. Tongue and groove

2.02 SMOOTH LINED CORRUGATED POLYETHYLENE PIPE

A. Pipe

1. Section 601.2(a)6.d.&e., Publication 408 Specifications

2. Section 601.2(a)6.g, Publication 408 Specifications

B. Joints

1. Hancor Titeline Watertight Joints or approved equal

PART 3 - EXECUTION

3.01 PREPARATION

A. Perform trench excavation to the line and grade shown on the Drawings and as specified in Section 31 23 33.

B. Provide pipe bedding as specified in PennDOT Publication 408 for each type of pipe used. Place aggregate in a manner to avoid segregation, and compact to the maximum practical density so that the pipe can be laid to the required tolerances.

3.02 LAYING PIPE IN TRENCHES

A. Give ample notice to the Resident Project Representative in advance of pipe laying operations.

B. Lower pipe into trench using handling equipment designed for the purpose to assure safety of personnel and to avoid damage to pipe. Do not drop pipe.

C. Lay pipe proceeding upgrade with the bell or groove pointing upstream.

D. Lay pipe to a true uniform line with the barrel of the pipe resting solidly in bedding material throughout its length. Excavate recesses in bedding material to accommodate joints, fittings, and appurtenances.

E. Lay each section of pipe to form a close concentric joint with the adjoining section and to avoid offsets in the flow line.

F. Clean and inspect each pipe and fitting before joining. Align pipe with previously laid sections.

G. Assemble joints in accordance with the pipe manufacturer's instructions. Pipe joints shall consist of a preformed rubber gasket or be mortared except for interlocking style pipe and pipe joined with bands.

1. For mortared joints, mortar the lower half of the joint before placing the succeeding pipe section to bring the inner surface of the abutting pipe flush. Before placing mortar, wet the pipe with as much water as it will readily absorb. Fill the outside of bell- and-spigot pipe joints with mortar, flush with the bell end. Fill tongue-and-groove pipe joints flush with the pipe's outside surface. On the inside of the pipe, fill the lower half of the joint flush with mortar, wipe clean, and finish smoothly. For pipes of 24-inch diameter and larger, fill the joints for the entire inside periphery in the same manner.

Fill voids for lift holes with mortar after pipe is placed.

H. Check each pipe installed as to line and grade in place. Correct deviation from line and grade immediately. A deviation from the designed grade as shown on the Drawings, or deflection of pipe joints, will be cause for rejection.

I. Place and compact sufficient backfill to hold each section of pipe firmly in place as the pipe is laid.

3.03 BACKFILLING TRENCHES

A. Backfill pipeline trenches only after examination of pipe laying by the Resident Project Representative.

1. If joints are mortared, backfilling may proceed immediately only if the operation will avoid joint damage, maintain pipe in proper alignment and grade, and provide satisfactory curing conditions for mortar.

B. Backfill and compact trenches as specified in Section 31 23 33.

END OF SECTION

SECTION 33.4116 - UNDERGROUND STORMWATER MANAGEMENT SYSTEM

PART 1 - GENERAL

1.01 SECTION DESCRIPTION

A. The Work Of This Section Includes:

1. An underground stormwater management system to provide for sediment removal, enhanced groundwater recharge, and/or surface water discharge for excess flow. The underground stormwater management system involves subsurface stormwater storage units rated for use under standard load applications within a stone filled area surrounded by geotextile fabric with associated observation ports, precast inflow diversion structures, and a precast outlet control structure.

B. Acceptable Manufacturer:

1. Precast structures, and frames and covers shall be provided by a firm regularly engaged in the manufacture of such products of the types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

2. Associated storm sewer structure frames and grates shall be provided from a Pennsylvania Department of Transportation Bulletin 15 listed supplier for that material or approved equal as reviewed and approved by the Engineer.

3. Subsurface stormwater storage units for the Underground Dry Extended Detention Basin shall be:

a. Aquabox by ADS, Inc.
b. DC 780 Stormtech Chamber isolator row by ADS, Inc.
c. N-12 riser by ADS, Inc.
d. A substitute or “or-equal,” subject to review and approved by the Engineer.

1.04 SUBMITTALS

A. Manufacturer's Literature:

1. Submit manufacturer's descriptive literature for the following items in accordance with Section 01 33 00:

- Subsurface stormwater storage unit
- Pipe
- Pipe fittings
- Joints
- Precast inlet boxes
- Precast outlet chamber
- Coarse aggregate
- Geotextile fabric
- Manhole frame & cover
- Inlet frame & grate
- Manhole steps

2. Submit manufacturer's instructions and recommendations for the following items in accordance with Section 01 33 00

   - Assembly of joints

B. Shop Drawings:

1. Submit manufacturer’s detailed shop drawings, including layout and connection of the subsurface stormwater storage units, observation ports, connections to pipes and inflow and outflow structures, and related details.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Subsurface stormwater storage units:

1. After fabrication, transport the units to the job site. Protect until required for installation.

2. Handle to avoid damage to surfaces, edges and corners and to avoid creation of stresses within the units.

3. Store and protect the units from rain and wind, and temperatures outside the range dictated by the manufacturer.

B. Pipe or Fittings:

1. Do not drop pipe or fittings.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Coarse Aggregate:

1. Foundation stone and embedment stone surrounding modules must be a clean, crushed, angular stone; AASHTO M43, 467, 5, 56, or 57.

B. Geotextile: per manufacturer’s recommendation(s) and Section 32.0519.13

C. Impermeable liner: 40 mil LLPDE

PART 3 - EXECUTION

3.01 EXCAVATION

A. Perform excavation and compact in conjunction with underground stormwater management system installation, to the line and grade shown on the Drawings and as specified in Section 31 23 33.

B. Locate inlet boxes, outlet chamber, and associated pipes as indicated on the Drawings.

3.02 CONSTRUCTION

A. Construct inlet structures of precast sections in compliance with the type, design and dimensions shown on the Drawings and in accordance with Publication 72.

B. Construct outlet structure of precast sections in compliance with the type design and dimensions shown on the Drawings and as specified herein.

C. Place coarse aggregate and install impermeable liner, geotextile, and in the lower portion of the underground stormwater management system to the bottom of the subsurface stormwater storage units to serve as bedding.

D. Install the subsurface stormwater storage units as shown on the Drawings and in accordance with the manufacturer's instructions.

1. Lay subsurface stormwater storage units to a true uniform line with the bottom of the units resting solidly in bedding material throughout its length. Excavate recesses in bedding material to accommodate joints, fittings, and appurtenances.

2. Lay each subsurface stormwater storage unit to form a close joint with the adjoining section and to avoid gaps.

3. Align subsurface stormwater storage units with previously laid sections in accordance with manufacturer's instructions.

4. Assemble joints in accordance with the manufacturer's instructions.

5. Check each subsurface stormwater storage unit installed as to line and grade in place. Correct deviation from line and grade immediately. A deviation from the designed grade as shown on the Drawings, or deflection of subsurface stormwater storage unit(s), will be cause for rejection.

E. Complete placement of coarse aggregate along, between, and over the piping system per manufacturer's instructions and recommendations and complete installation of impermeable liner on all sides and complete installation of impermeable geotextiles on all sides and over the bed of aggregate. This shall proceed only after examination of the subsurface stormwater storage unit installation by the Resident Project Representative.

F. Backfill area over and around the underground stormwater management system to rough grade elevations as specified in Section 31 23 33.

END OF SECTION

SECTION 33.4414 - STORM INLETS, BOXES, MANHOLES, AND ENDWALLS

PART 1 - GENERAL

1.01 SECTION DESCRIPTION

A. This Work is the supply and construction of storm inlets, boxes, manholes, and endwalls in accordance with the Drawings, Contract Documents, and as directed by the Resident Project Representative.

1.02 QUALITY ASSURANCE

A. Reference Standards:
   1. Pennsylvania Department of Transportation
      a. Publication 408 Specifications
      b. Publication 72 Roadway Construction Standards
         i. RC-31 - Endwalls
         ii. RC-39 – Storm Water Manholes
         iii. RC-45 – Inlet Tops, Grates, and Frames
         iv. RC-46 – Inlet Boxes
      c. Publication 35 (Bulletin 15) Qualified Products List for Construction

B. Acceptable Manufacturer:
   1. Precast concrete structures, inlet grates and frames, manhole frames and covers, and manhole steps, shall be supplied by a manufacturer listed in Bulletin 15 or approved equal.
   2. Galvanizing shall be from a galvanizer listed in Bulletin 15 or approved equal.

1.03 SUBMITTALS

A. Shop Drawings:
   1. Submit detailed shop drawings including reinforcing steel details in accordance with Section 01 33 00.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Precast Concrete Units:
   1. After fabrication and curing, transport the units to the job site. Protect until required for installation.
   2. Handle to avoid damage to surfaces, edges and corners and to avoid creation of stresses within the units.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Coarse Aggregate Subbase: PennDOT #2A or AASHTO #8, Table C, Section 703.2, Publication 408 Specifications.

B. Brick: Section 713.1(a), Publication 408.

C. Masonry Mortar: Section 705.6(b), Publication 408

D. Malleable Iron Castings: Section 1105.2(h)2, Publication 408.

E. Ductile Iron Castings: Section 1105.2(h)3, Publication 408.

F. Structural Steel: Section 1105.2(a)3.c, Publication 408.

2.02 CONCRETE : Class AA, Section 704, Publication 408; except with a minimum 28-day compressive strength of 4,000 psi.

A. Inlets, Grates, and Frames:

1. Comply with the type, design, and dimensions shown on the Drawings and in accordance with Publication 72 (RC-45) for precast units.

B. Inlet Boxes:

1. Comply with the type, designs and dimensions shown on the Drawings and in accordance with Publication 72 (RC-46).

C. Manholes, Frames, and Covers:

1. Comply with the type, design, and dimensions shown on the Drawings and in accordance with Publication 72 (RC-39).

2. Frames and Covers shall include non-slip pattern and be inscribed as shown on the Drawings with raised letters. Letter shall have a height and width of not less than 2 inches.

D. Endwalls:

1. Comply with the type, design, and dimensions shown on the Drawings and in accordance with Publication 72 (RC-31) for precast units.

PART 3 – EXECUTION

3.01 EXCAVATION

A. Perform trench excavation to the line and grade shown on the Drawings and as specified in Section 31 23 33.

B. Location and depth of boxes and manholes as shown on the Drawings.

3.02 CONSTRUCTION

A. Provide precast concrete inlets and boxes, and manholes in compliance with the type, design and dimensions shown on the Drawings and in accordance with Publication 72 (RC-39, RC-45, and RC-46). Cast-in-place construction shall be permitted when indicated on the Drawings or at the direction of the Resident Project Representative.

1. Place precast units on a 12" coarse aggregate subbase placed in 4" layers compacted to 95% of dry weight density.

2. Construct cast-in-place units on undisturbed earth.

3. Shape bottom of inlet boxes and manholes to channel flow of water to the outlet pipe and to prevent water from standing in box.

4. Unless units are cast-in-place, use precast concrete sections or brick to adjust to grade. Mortar in place.

B. Construct endwalls of either precast units or cast-in-place construction in compliance with the type, design and dimensions shown on the Drawings and in accordance with Publication 72 (RC-31).

1. Cast-in-place endwalls shall be monolithically cast reinforced concrete units.

C. Do not permit pipes to project more than 2" into inlets. Do not expose end of pipe through faces of endwalls.

3.03 BACKFILLING

A. Backfill structures only after examination by the Resident Project Representative.

B. Perform backfilling and compaction as specified in Section 31 23 33.

END OF SECTION

SECTION 33.7119 - ELECTRICAL UNDERGROUND DUCTS, DUCTBANKS, AND MANHOLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Conduit and duct:

1. Galvanized steel rigid metal conduit (RMC).
2. Rigid polyvinyl chloride (PVC) conduit.

B. Precast concrete manholes.

C. Cast-in-place manhole accessories.

D. Accessories:

1. Underground warning tape.

1.2 RELATED REQUIREMENTS

A. Section 03 1000 - Concrete Forming and Accessories.

B. Section 03 2000 - Concrete Reinforcing.

C. Section 03 3000 - Cast-in-Place Concrete.

D. Section 07 1113 - Bituminous Dampproofing.

E. Section 22 1006 - Plumbing Piping Specialties.

F. Section 31 2316 - Excavation.

G. Section 31 2323 - Fill: Bedding and backfilling.

1.3 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.

B. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2022.

C. ASTM C857 - Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures; 2019.

D. ASTM C858 - Standard Specification for Underground Precast Concrete Utility Structures; 2019.

E. ASTM C891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures; 2020.

F. ASTM C1037 - Standard Practice for Inspection of Underground Precast Concrete Utility Structures; 2016.

G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

H. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.

I. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.

J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

L. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

M. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide for metallic conduit, nonmetallic conduit, and manhole accessories.

C. Shop Drawings: Indicate dimensions, reinforcement, size and locations of openings, and accessory locations for precast manholes.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Project Record Documents: Record actual routing and elevations of underground conduit and duct, and locations and sizes of manholes.

1.5 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.1 CONDUIT AND DUCT

A. Galvanized Steel Rigid Metal Conduit (RMC): NFPA 70, Type RMC; comply with ANSI C80.1 and list and label as complying with UL 6.

1. Manufacturers:
   a. Allied Tube & Conduit; _____: www.alliedeg.com/#sle.
   b. Republic Conduit; _____: www.republic-conduit.com/#sle.
   c. Wheatland Tube, a Division of Zekelman Industries; _____: www.wheatland.com/#sle.
   d. Substitutions: See Section 01 6000 - Product Requirements.
2. Fittings: Comply with NEMA FB 1 and list and label as complying with UL 514B; steel or malleable iron, threaded type.
   a. Manufacturers:
      1) Bridgeport Fittings Inc; _____: www.bptfittings.com/#sle.
      2) O-Z/Gedney, a brand of Emerson Electric Co; _____: www.emerson.com/#sle.
      3) Thomas & Betts Corporation; _____: www.tnb.com/#sle.
      4) Substitutions: See Section 01 6000 - Product Requirements.

B. Rigid Polyvinyl Chloride (PVC) Conduit: NFPA 70, Type PVC; comply with NEMA TC 2 and list and label as complying with UL 651; Schedule 40 unless otherwise indicated; rated for use with conductors rated 90 degrees C.

1. Manufacturers:
   a. Cantex Inc; _____: www.cantexinc.com/#sle.
   b. Carlon, a brand of Thomas & Betts Corporation; _____: www.carlon.com/#sle.
   c. JM Eagle; _____: www.jmeagle.com/#sle.
   d. Substitutions: See Section 01 6000 - Product Requirements.
2. Fittings: Comply with NEMA TC 3 and list and label as complying with UL 651.
   a. Manufacturer: Same as manufacturer of conduit to be connected.

2.2 PRECAST CONCRETE MANHOLES

A. Manufacturers:
   1. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: Precast manhole designed in accordance with ASTM C858, comprising modular, interlocking sections complete with accessories.

C. Loading: ASTM C857, Class A-16.

D. Shape: Square.

E. Base Section: Include 3 inch deep x 14 inch round sump with cast sleeve, and two 1 inch ground rod openings.

F. Top Section: Include 39 inch diameter grooved opening for frame and cover.

G. Riser Casting: 6 inch, with manhole step cast into frame.

H. Frames and Covers: ASTM A48/A48M; Class 30B gray cast iron, 27 inch size, machine finished with flat bearing surfaces. Provide cover marked ELECTRIC to indicate utility.

I. Duct Entry Provisions: Single duct knockouts.

J. Duct Entry Size: 4 inch.

K. Cable Pulling Irons: Use galvanized rod and hardware. Locate opposite each duct entry. Provide watertight seal.

L. Cable Rack Inserts: Minimum load rating of 800 pounds (365 kg). Locate at ___ feet on center.

M. Cable Rack Mounting Channel: 1-1/2 x 3/4 inch steel channel, 48 inch length. Provide cable rack arm mounting slots on 1-1/2 inch centers.

N. Cable Racks: Steel channel, 1-1/2 x 3/4 x 14 inches, with fastener to match mounting channel.

O. Cable Supports: Porcelain clamps and saddles.

P. Manhole Steps: Polypropylene plastic manhole step with 1/2-inch steel reinforcement.

Q. Sump Covers: ASTM A48/A48M; Class 30B gray cast iron.

2.3 CAST-IN-PLACE MANHOLE ACCESSORIES

A. Frames and Covers: ASTM A48/A48M; Class 30B gray cast iron, 27 inch size, machine finished with flat bearing surfaces. Provide cover marked ELECTRIC to indicate utility.

B. Cable Pulling Irons: Use galvanized rod and hardware.

C. Cable Rack Inserts: Minimum load rating of 800 pounds.

D. Cable Rack Mounting Channel: 1-1/2 x 3/4 inch steel channel, 48 inch length. Provide cable rack arm mounting slots on 1-1/2 inch centers.

E. Cable Racks: Steel channel, 1-1/2 x 3/4 x 14 inches, with fastener to match mounting channel.

F. Cable Supports: Porcelain clamps and saddles.

G. Manhole Steps: Polypropylene plastic manhole step with 1/2-inch steel reinforcement.

H. Sump Covers: ASTM A48/A48M; Class 30B gray cast iron.

2.4 ACCESSORIES

A. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for the conduit/duct arrangement to be installed.

1. Products:
   a. Advance Products & Systems, LLC; Duct Bank Spacers: www.apsonline.com/#sle.
   b. Substitutions: See Section 01 6000 - Product Requirements.

B. Bore Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for installation within casing; furnished with roller wheels to facilitate installation, openings to facilitate grout flow, and holes for stabilization cable; suitable for the casing and conduit/duct arrangement to be installed.

1. Products:
   a. _____.
   b. Substitutions: See Section 01 6000 - Product Requirements.

C. Underground Warning Tape: Polyethylene tape suitable for direct burial.

1. Manufacturers:
   a. Brady Corporation; _____: www.bradyid.com/#sle.
   b. Brimar Industries, Inc; _____: www.brimar.com/#sle.
   c. Seton Identification Products; _____: www.seton.com/#sle.
   d. Substitutions: See Section 01 6000 - Product Requirements.

2. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.
3. Legend: Type of service, continuously repeated over full length of tape.
4. Color:
   a. Tape for Buried Power Lines: Black text on red background.
   b. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.5 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Precast Manholes: Inspect in accordance with ASTM C1037.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify routing and termination locations of duct bank prior to excavation for rough-in.

C. Verify locations of manholes prior to excavating for installation.

D. Duct bank routing is shown in approximate locations unless dimensions are indicated. Route as required to complete duct system.

E. Manhole locations are shown in approximate locations unless dimensions are indicated. Locate as required to complete ductbank system.

3.2 DUCT BANK INSTALLATION

A. Install duct to locate top of ductbank at depths as indicated on drawings.

B. Install duct with minimum slope of 4 inches per 100 feet (0.33 percent). Slope duct away from building entrances.

C. Cut duct square using saw or pipe cutter; de-burr cut ends.

D. Insert duct to shoulder of fittings; fasten securely.

E. Join nonmetallic duct using adhesive as recommended by manufacturer.

F. Wipe nonmetallic duct dry and clean before joining. Apply full even coat of adhesive to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

G. Install no more than equivalent of three 90-degree bends between pull points.

H. Provide suitable fittings to accommodate expansion and deflection where required.

I. Terminate duct at manhole entries using end bell.

J. Stagger duct joints vertically in concrete encasement 6 inches minimum.

K. Use suitable separators and chairs installed not greater than 4 feet on centers.

L. Band ducts together before backfilling.

M. Securely anchor duct to prevent movement during concrete placement.

N. Place concrete under provisions of Section 03 3000. Use mineral pigment to color concrete red.

O. Provide minimum 3 inch concrete cover at bottom, top, and sides of ductbank.

P. Provide two No. 4 steel reinforcing bars in top of bank under paved areas.

Q. Provide suitable pull string in each empty duct except sleeves and nipples.

R. Swab duct. Use suitable caps to protect installed duct against entrance of dirt and moisture.

3.3 PRE-CAST MANHOLE INSTALLATION

A. Excavate for manhole installation under the provisions of Section 31 2316.

B. Install and seal precast sections in accordance with ASTM C891.

C. Install manholes plumb.

D. Use precast neck and shaft sections to bring manhole cover to finished elevation.

E. Attach cable racks to inserts after manhole installation is complete.

F. Install drains in manholes and connect to site drainage system under provisions of Section 22 1006.

G. Install drains in manholes and connect to 4 inch pipe terminating in 1/3 cu yd crushed gravel bed under provisions of Section 22 1006.

H. Dampproof exterior surfaces, joints, and interruptions of manholes after concrete has cured 28 days, under provisions of Section 07 1113.

I. Backfill manhole excavation under the provisions of Section 31 2323.

3.4 CAST-IN-PLACE MANHOLE INSTALLATION

A. Excavate for manhole installation under the provisions of Section 31 2316.

B. Formwork: Form inside and outside manhole surfaces in accordance with provisions of Section 03 1000.

C. Reinforcing: Install reinforcing under the provisions of Section 03 2000.

D. Concrete: Provide air-entrained, 2000 psi compressive strength at 28 days under the provisions of Section 03 3000.

E. Shape: Square.

F. Base: Include 14 inch drain opening and two 1 inch ground rod openings. Slope to drain at 0.25 inch per foot (2 percent).

G. Top: Include 39 inch diameter opening; cast 1/2 inch rod in opening to accept ladder hook.

H. Duct Entry: Cast duct openings in walls as indicated.

I. Cable Pulling Irons: Locate opposite each duct entry.

J. Construct brick collar with 30 inch clear opening to bring cover to proper elevation.

K. Manhole Steps: Cast steps at 12 inches on center vertically.

L. Install ladder in each manhole.

M. Attach cable racks to inserts after manhole construction is complete.

N. Install drains in manholes and connect to site drainage system under provisions of Section 22 1006.

O. Install drains in manholes and connect to 4 inch pipe terminating in 0.33 cu yd crushed gravel bed under provisions of Section 22 1006.

P. Dampproof exterior surfaces, joints, and interruptions of manholes after concrete has cured 28 days, under provisions of Section 07 1113.

Q. Backfill manhole excavation under the provisions of Section 31 2323.

END OF SECTION 33.7119